NASA SP-7041 (09)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

ISSUE 9
JUNE 1976

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA SP-7041(09) Earth Resources Pages 1-59 JUNE 1976

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

Remote Sensing of Earth Resources	(NASA SP-7036)
Remote Sensing of Earth Resources	(NASA SP-7036(01))
Earth Resources	(NASA SP-7041(01))
Earth Resources	(NASA SP-7041(02))
Earth Resources	(NASA SP-7041(03))
Earth Resources	(NASA SP-7041(04))
Earth Resources	(NASA SP-7041(05))
Earth Resources	(NASA SP-7041(06))
Earth Resources	(NASA SP-7041(07))
Earth Resources	(NASA SP-7041(08))

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NASA SP-7041 (09)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 9

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1976 and March 1976 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

Scientific and Technical Information Office JUNE 1976
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D.C.

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INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 418 reports, articles, and other documents announced between January and March 1976 in *Scientific and Technical Aerospace Reports(STAR)*, and *International Aerospace Abstracts(IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

IAA entries identified by accession number series A76-10,000 in ascending accession number order.

STAR entries identified by accession number series N76-10,000 in ascending accession number order;

After the abstract section, there are five indexes:

subject, personal author, corporate source, contract number and report/accession number.

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A76-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche[1] are available at the rate of $1.50 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g., (A76-10543), when requesting publications.

STAR ENTRIES (N76-10000 Series)

One or more sources from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

Avail: NTIS. Sold by the National Technical Information Service to U.S. customers at the price shown in the citation following the letters HC (hard, paper, or facsimile copy). Customers outside the U.S. should add $2.50 per copy for handling and postage charges to the price shown. (Prices shown in earlier *STAR* volumes, 1962-1975, have been superseded but may be calculated from the number of pages shown in the citation. The price schedule by page count was published in *STAR* Numbers 2 and 3 of 1976, or it may be obtained from NTIS.)

Microfiche[1] is available at a standard price of $2.25 (plus $1.50 for non-U.S. customers) regardless of source or the quality of the fiche, for those accessions followed by a # symbol. Accession numbers followed by a + sign are not available as microfiche because of size or reproducibility.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Unit.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

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Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: ERDA Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Energy Research and Development Administration reports, usually in microfiche form, are listed in *Nuclear Science Abstracts*. Services available from the ERDA and its depositories are described in a booklet, *Science Information Available from the Energy Research and Development Administration* (TID-4550), which may be obtained without charge from the ERDA Technical Information Center.

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Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

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Avail: U.S. Patent Office. Sold by Commissioner of Patents, U.S. Patent Office, at the standard price of 50 cents each, postage free.

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New York, N.Y. 10017

British Library Lending Division,
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England

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

Energy Research and Development
Administration
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

ESA - Space Documentation Service
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Via Galileo Galilei
00044 Frascati (Rome), Italy.

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345 Middlefield Road
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mentation und -Information
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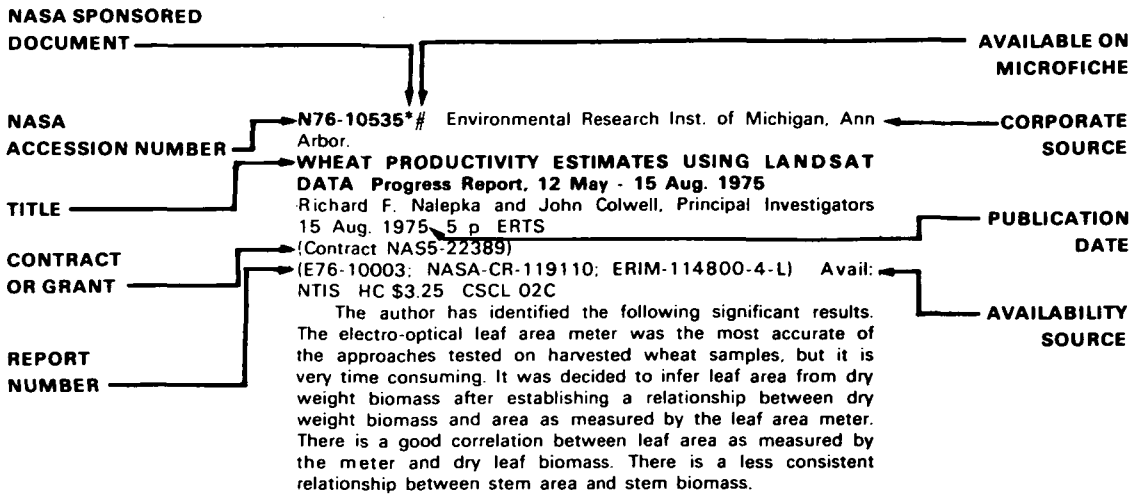
TABLE OF CONTENTS

Subject Categories

Abstracts in this Bibliography are grouped under the following categories: *page:*

TYPICAL CITATION AND ABSTRACT FROM *STAR*



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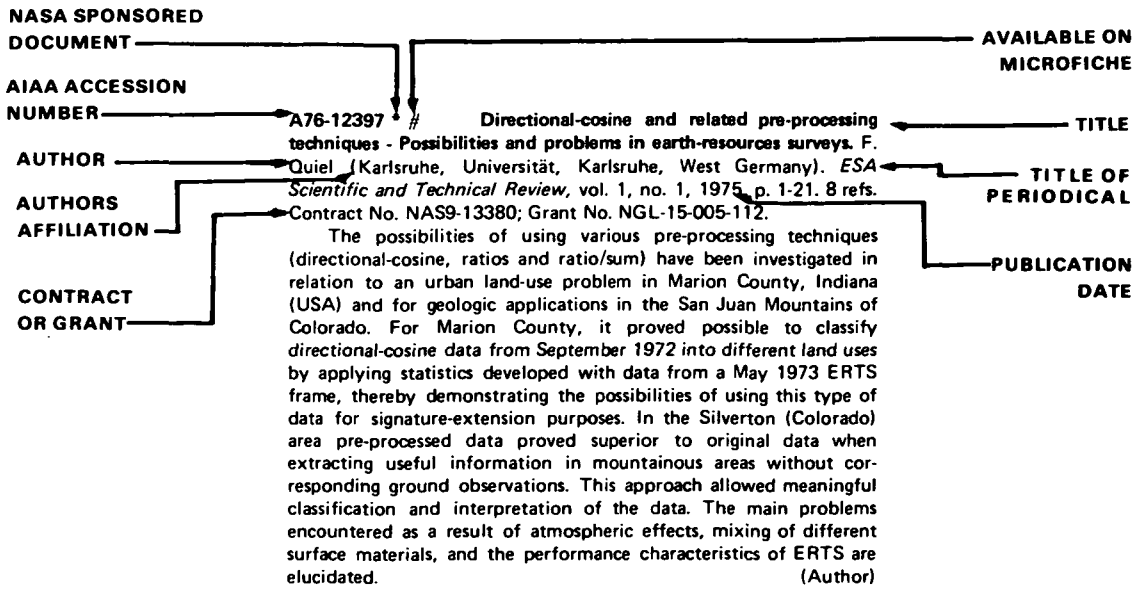

EARTH RESOURCES

A Continuing Bibliography (Issue 9)

JUNE 1976

01
AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

A76-14496 * **Plant, soil, and shadow reflectance components of row crops.** A. J. Richardson, C. L. Wiegand, H. W. Gausman, J. A. Cuellar, and A. H. Gerbermann (U.S. Department of Agriculture, Weslaco, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 41, Nov. 1975, p. 1401-1407. 15 refs. NASA Order S-70251-AG.

Data from the first Earth Resource Technology Satellite (LANDSAT-1) multispectral scanner (MSS) were used to develop three plant canopy models (Kubelka-Munk (K-M), regression, and combined K-M and regression models) for extracting plant, soil, and shadow reflectance components of cropped fields. The combined model gave the best correlation between MSS data and ground truth, by accounting for essentially all of the reflectance of plants, soil, and shadow between crop rows. The principles presented can be used to better forecast crop yield and to estimate acreage. (Author)

A76-15499 **Soil and land cover overlay analyses.** H. C. Hitchcock, T. L. Cox, F. P. Baxter, and C. W. Smart (Tennessee Valley Authority, Norris, Tenn.). *Photogrammetric Engineering and Remote Sensing,* vol. 41, Dec. 1975, p. 1519-1524. 7 refs.

Soil survey data for Knox County, Tennessee, were coded in 2.68-acre cells registered to geodetic coordinates; land cover information classified from geometrically corrected ERTS scanner data was processed and assigned to geodetic cells of the same size through the use of a special computer program. Ground registration of data permitted overlay analysis which greatly enhanced the value of both data sets. (Author)

A76-15764 # **The pyroelectric vidicon and its use in forest-fire mapping.** W. E. Pinson (Infrared Photo, Ltd., Ottawa, Canada) and P. H. Kourtz (Department of the Environment, Forest Fire Research Institute, Ottawa, Canada). *Canadian Journal of Remote Sensing,* vol. 1, Nov. 1975, p. 60-66.

This report concerns an infrared imaging device, pyroelectric vidicon or Pyricon, which is sensitive throughout the infrared range of the spectrum, operates at room temperature, and is one-third the cost of a line scanner. During the summer of 1974, this Pyricon was mounted in a light aircraft, and its ability to map small forest fires was tested. The operation of the Pyricon and the results of these tests are described. (Author)

A76-16294 * **Cropland acreage estimates from temporal, multispectral ERTS-1 data.** R. E. Carlson and C. Aspiazu (Iowa State University of Science and Technology, Ames, Iowa). *Remote Sensing of Environment,* vol. 4, no. 3, 1975, p. 237-243. Contract No. NAS5-21839.

Temporal, multispectral Earth Resources Technology Satellite (ERTS-1) images as pertinent to cropland acreage estimates are illustrated and discussed. A cropland classifier is described that evaluates approximately registered, temporal, and multispectral digital ERTS-1 data acquired over a 14 section test site in central Iowa during 1973. Satellite-derived acreage estimates are compared with estimates derived from low-level images. Discrepancies between these estimates are discussed. Satellite coverage critically timed with a crop development calendar is noted to improve classifier effectiveness. (Author)

N76-10535*# Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 12 May - 15 Aug. 1975
Richard F. Nalepka and John Colwell, Principal Investigators 15 Aug. 1975 5 p ERTS
(Contract NAS5-22389)
(E76-10003; NASA-CR-119110; ERIM-114800-4-L) Avail: NTIS HC $3.25 CSCL 02C

The author has identified the following significant results. The electro-optical leaf area meter was the most accurate of the approaches tested on harvested wheat samples, but it is very time consuming. It was decided to infer leaf area from dry weight biomass after establishing a relationship between dry weight biomass and area as measured by the leaf area meter. There is a good correlation between leaf area as measured by the meter and dry leaf biomass. There is a less consistent relationship between stem area and stem biomass.

N76-10541*# Texas A&M Univ., College Station. Report Sensing Center.
APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Progress Report, Feb. - Apr. 1975
John W. Rouse, Jr., Principal Investigator Sep. 1975 38 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-20796)
(E76-10009; NASA-CR-119117; RSC-3018-1) Avail: NTIS HC $3.75 CSCL 08F

N76-10545*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING Progress Report, 7 Jun. - 7 Sep. 1975
Robert W. Aldrich, Principal Investigators and Edwin H. Roberts 18 Sep. 1975 5 p ERTS
(NASA Order S-54053-A)
(E76-10013; NASA-CR-119121; PR-2) Avail: NTIS HC $3.25 CSCL 02F

N76-10547*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
INTERPRETATION AND MAPPING OF GYPSY MOTH DEFOILATION FROM ERTS (LANDSAT)-1 TEMPORAL

COMPOSITES Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and W. S. Kowalik Jun. 1975 12 p refs ERTS
(Contract NAS5-23133)
(E76-10015; NASA-CR-119123; ORSER-SSEL-TR-22-74) Avail: NTIS HC $3.25 CSCL 02F

The author has identified the following significant results. Photointerpretation of temporally composited color Diazo transparencies of ERTS(LANDSAT) images is a practical method for detecting and locating levels of widespread defolitation. ERTS 9 x 9 inch images are essentially orthographic and are produced at a nearly constant 1:1,000,000 scale. This allows direct superposition of scenes for temporal composites. ERTS coverage provides a sweeping 180 km (110 mile) wide view, permitting one interpreter to rapidly delineate defoliation in an area requiring days and weeks of work by aerial surveys or computerized processing. Defoliation boundaries can be located on the images within maximum errors on the order of hundreds of meters. The enhancement process is much less expensive than aerial surveys or computerized processing. Maps produced directly from interpretation are manageable working products. The 18 day periodic coverage of ERTS is not frequent enough to replace aerial survey mapping because defoliation and refoliation move as waves.

N76-10569*# Ohio Agricultural Research and Development Center, Wooster.
GROWN ORGANIC MATTER AS A FUEL RAW MATERIAL RESOURCE Final Report
Warren L. Roller, Harold M. Keener, Rochelle D. Kline, Henry J. Mederski, and R. Bruce Curry Washington NASA Oct. 1975 134 p refs
(Grant NGL-36-007-001)
(NASA-CR-2608) Avail: NTIS HC $5.75 CSCL 10A

An extensive search was made on biomass production from the standpoint of climatic zones, water, nutrients, costs and energy requirements for many species. No exotic species were uncovered that gave hope for a bonanza of biomass production under culture, location, and management markedly different from those of existing agricultural concepts. A simulation analysis of biomass production was carried out for six species using conventional production methods, including their production costs and energy requirements. These estimates were compared with data on food, fiber, and feed production. The alternative possibility of using residues from food, feed, or lumber was evaluated. It was concluded that great doubt must be cast on the feasibility of producing grown organic matter for fuel, in competition with food, feed, or fiber. The feasibility of collecting residues may be nearer, but the competition for the residues for return to the soil or cellulosic production is formidable. Author

N76-11512 Joint Publications Research Service, Arlington, Va.
PRINCIPLES AND METHODS FOR STUDYING FORESTS FROM SPACE
A. S. Isayev and D. M. Kireyev *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 24-29 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p

An important factor in space observation of forests is the regularity of collection of repeated information which gives the changes in a dynamic system such as a forest. From satellites, it is possible to register the mass multiplication of forest pests, forest fires, wind and storm falls over great areas, floods, inundations and waterlogging within the limits of coastal zones. J.A.M.

N76-11513 Joint Publications Research Service, Arlington, Va.
PROBLEMS IN REMOTE SENSING OF LAND RESOURCES AND AGRICULTURAL CROPS
G. S. Yelesin *In its* Exploration of Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 30-35 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p

It is possible to distinguish the following levels of information use for land resources and sown areas of agriculture by remote methods: (1) farm, (2) region, (3) oblast, (4) union republic, and (5) the country as a whole. The need for routine information on agricultural processes, such as sowing, cultivation, and harvesting, is emphasized. Aerospace techniques can provide this data for agriculture, as well as information on natural calamities. J.A.M.

N76-11521*# Arizona Univ., Tucson. Office of Arid Lands Studies.
A STUDY TO EXPLORE THE USE OF ORBITAL REMOTE SENSING TO DETERMINE NATIVE ARID PLANT DISTRIBUTION Final Report, Jul. 1971 - Dec. 1974
W. G. McGinnies, Principal Investigator, J. S. Conn, E. F. Haase, L Lepley, K., H. B. Musick, and K. E. Foster Jun. 1975 75 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21812)
(E76-10023; NASA-CR-145416) Avail: NTIS HC $4.50 CSCL 08F

The author has identified the following significant results. Research results include a method for determining the reflectivities of natural areas from ERTS data taking into account sun angle and atmospheric effects on the radiance seen by the satellite sensor. Ground truth spectral signature data for various types of scenes, including ground with and without annuals, and various shrubs were collected. Large areas of varnished desert pavement are visible and mappable on ERTS and high altitude aircraft imagery. A large scale and a small scale vegetation pattern were found to be correlated with presence of desert pavement. A comparison of radiometric data with video recordings shows quantitatively that for most areas of desert vegetation, soils are the most influential factor in determining the signature of a scene. Additive and subtractive image processing techniques were applied in the dark room to enhance vegetational aspects of ERTS.

N76-11522*# Oregon State Univ., Corvallis.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT: A COMPREHENSIVE EVALUATION OF ERTS-1 IMAGERY Progress Report, Jul. 1972 - Apr. 1974
Barry J. Schrumpf, Principal Investigator, James R. Johnson, David A. Mouat, and William T. Pyott Dec. 1974 347 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21831)
(E76-10024; NASA-CR-145417) Avail: NTIS HC $10.00 CSCL 08F

The author has identified the following significant results. A vegetation classification, with 31 types and compatible with remote sensing applications, was developed for the test site. Terrain features can be used to discriminate vegetation types. Elevation and macrorelief interpretations were successful on ERTS photos, although for macrorelief, high sun angle stereoscopic interpretations were better than low sun angle monoscopic interpretations. Using spectral reflectivity, several vegetation types were characterized in terms of patterns of signature change. ERTS MSS digital data were used to discriminate vegetation classes at the association level and at the alliance level when image contrasts were high or low, respectively. An imagery comparison technique was developed to test image complexity and image groupability. In two stage sampling of vegetation types, ERTS plus high altitude photos were highly satisfactory for estimating kind and extent of types present, and for providing a mapping base.

N76-11524*# South Dakota State Univ., Brookings. Remote Sensing Inst.
INVESTIGATION OF REMOTE SENSING TECHNIQUES AS

INPUTS TO OPERATIONAL RESOURCE MANAGEMENT MODELS Interim Report, 11 Jun. - 10 Sep. 1975
Fred A. Schmer, Principal Investigator and Robert E. Isakson Sep. 1975 16 p ref Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20982)
(E76-10026; NASA-CR-145419; RSI-SDSU-75-08) Avail: NTIS HC $3.50 CSCL 08F

N76-11526*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 4 Apr. - 3 Jul. 1975
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 4 Oct. 1975 3 p ERTS
(NASA Order S-54049-A)
(E76-10028; NASA-CR-145420) Avail: NTIS HC $3.50 CSCL 08B

N76-11530*# Agricultural Research Service, Weslaco, Tex.
SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS Quarterly Progress Report, 13 Jul. - 13 Oct. 1975
Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Oct. 1975 23 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-53876-AG)
(E76-10032; NASA-CR-145424) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. To distinguish dead from live vegetation, spectrophotometrically measured infinite reflectance of dead and live corn (Zea mays L.) leaves were compared over the 0.5 to 2.5 micron waveband. Dead leaf reflectance was reached over the entire 0.5 to 2.5 micron waveband by stacking only two to three leaves. Live leaf reflectance was attained by stacking two leaves for the 0.5 to 0.75 micron waveband (chlorophyll absorption region), eight leaves for the 0.75 to 1.35 micron waveband (near infrared region), and three leaves for the 1.35 to 2.5 micron waveband (water absorption region). LANDSAT-1 MSS digital data for 11 December 1973 overpass were used to estimate the sugar cane acreage in Hidalgo County. The computer aided estimate was 22,100 acres compared with the Texas Crop and Livestock Reporting Service estimate of 20,500 acres for the 1973-'74 crop year. Although there were errors of omission from harvested fields that were identified as bare soil and some citrus and native vegetation that were mistakenly identified as sugar cane, the mapped location of sugar cane fields in the county compared favorably with their location on the thematic map generated by the computer.

N76-11531*# Purdue Univ., Lafayette, Ind.
CROP IDENTIFICATION AND ACREAGE ESTIMATION OVER LARGE GEOGRAPHIC AREAS USING LANDSAT MSS DATA Quarterly Progress Report, 1 Jul. - 30 Sep. 1975
Marvin E. Bauer, Principal Investigator 30 Sep. 1975 2 p ERTS
(Contract NAS5-20793)
(E76-10033; NASA-CR-145426) Avail: NTIS HC $3.50 CSCL 08F

N76-11534*# *Pennsylvania Univ., Philadelphia. Museum* Applied Science Center for Archaeology.
DETECTION OF CROP MARK CONTRAST FOR ARCHAEOLOGICAL SURVEYS Progress Report
Bruce Bevan, Principal Investigator 8 Oct. 1975 3 p ERTS
(Contract NAS5-20792)
(E76-10036; NASA-CR-145427; QPR-3) Avail: NTIS HC $3.50 CSCL 08B

N76-11536*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE ERTS-1 INVESTIGATION (ER-600). VOLUME 3: ERTS-1 FOREST ANALYSIS Technical Report, Jul. 1972 - Jun. 1973
R. Bryan Erb Jun. 1974 105 p refs Original contains color illustrations
(NASA-TM-X-58119; JSC-08458-Vol-3) Avail: NTIS HC $5.50 CSCL 02F

The Forest Analysis Team of the Lyndon B. Johnson Space Center Earth Observations Division conducted a year's investigation of LANDSAT 1 multispectral data to determine the size of forest features that could be detected and to determine the suitability for making forest classification maps. The Sam Houston National Forest of Texas was used as the test site. Using conventional interpretation and computer aided techniques, the team was able to differentiate up to 14 classes of forest features to an accuracy ranging between 55 and 84 percent. Author

N76-11537*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE ERTS-1 INVESTIGATION (ER-600). VOLUME 4: ERTS-1 RANGE ANALYSIS Technical Report, Jul. 1972 - Jun. 1973
R. Bryan Erb Jun. 1974 173 p refs Original contains color illustrations
(NASA-TM-X-58120; JSC-08459-Vol-4) Avail: NTIS HC $6.75 CSCL 08F

The Range Analysis Team conducted an investigation to determine the utility of using LANDSAT 1 data for mapping vegetation-type information on range and related grazing lands. Two study areas within the Houston Area Test Site (HATS) were mapped to the highest classification level possible using manual image interpretation and computer aided classification techniques. Rangeland was distinguished from nonrangeland (water, urban area, and cropland) and was further classified as woodland versus nonwoodland. Finer classification of coastal features was attempted with some success in differentiating the lowland zone from the drier upland zone. Computer aided temporal analysis techniques enhanced discrimination among nearly all the vegetation types found in this investigation. Author

N76-11548*# Pan American Univ., Edinburg, Tex.
FURTHER TESTS OF PLANT CANOPY REFLECTANCE MODELS AND INVESTIGATION OF NON-LAMBERTIAN PROPERTIES OF PLANT CANOPIES Final Technical Report, 1 Sep. 1974 - 31 Aug. 1975
E. W. LeMaster Nov. 1975 64 p refs
(Contract NsG-9015)
(NASA-CR-145615) Avail: NTIS HC $4.50 CSCL 02C

The experimental bidirectional reflectance of cotton is *presented and compared to the Suits vegetation model. Some* wheat reflectance data are presented for a Mexican dwarf wheat. The general results are that the exchange of source position and detector position gives the same reflectance measurement if the irradiance is purely specular. This agrees with Suites. The reflectance versus sun angle and reflectance versus detector angle do not agree with the Suits predictions. There is qualitative agreement between the Suits model and reflectance versus wavelength, but quantitative agreement has not been observed. Reflectance of a vegetation canopy with detector azimuth shows a change of 10 to 40% for even sun angles near zenith, so it seems advisable to include azimuthal angles into models of vegetation. Author

N76-11655 Food and Agriculture Organization of the United Nations, Rome (Italy).
MEASUREMENTS OF EVAPOTRANSPIRATION
D. Rijks *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 105-114 refs

Evapotranspiration is defined, and its importance to farming in Africa is assessed. Methods of measuring evapotranspiration by deduction and directly are described, and its calculation when measurements cannot be made is discussed. ESA

N76-11658 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
POTENTIAL EVAPOTRANSPIRATION CALCULATIONS AND THEIR USE IN IRRIGATION
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 115-119 refs

Copyright.

The calculation of potential evapotranspiration by various methods is described. The use and precision of evapotranspiration estimates is discussed especially in relation to irrigation. ESA

N76-11660 National Agricultural Research Station, Kitale (Kenya).
MAIZE PRODUCTION TRENDS IN KENYA AND THE INFLUENCE OF SEASONAL RAINFALL VARIATIONS ON OUTPUT
A. Y. Allan *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 161-168 refs Sponsored by Overseas Develop. Admin.
Copyright.

The problems of estimating the annual production of maize in Kenya are discussed. Causes for the seasonal fluctuation in crop yields are considered, and a method for predicting future production is suggested. ESA

N76-11661 National Agricultural Research Station, Kitale (Kenya).
SOIL PHYSICAL CONDITIONS UNDER MAIZE
P. J. M. Cooper *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 169-186 refs Sponsored by Overseas Develop. Admin.
Copyright.

The effect of soil temperature, soil moisture, and soil aeration on the production and yield of maize in Kenya is discussed. Methods for measuring the three parameters are described, and results of measurements are tabulated. Tentative conclusions are drawn. ESA

N76-11662 National Agricultural Research Station, Kitale (Kenya).
PRELIMINARY FINDINGS OF A STUDY OF THE GROWTH OF MAIZE IN KENYA
R. Law *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 187-196 refs Sponsored by Overseas Develop. Admin.
Copyright.

Results of experiments conducted at NARS, Kitale, Kenya on the growth patterns of maize varieties, and the effect of the time of planting on the growth pattern are discussed. Factors causing reduced yields in late planted maize are analyzed, and it is tentatively concluded that soil temperature may be a *critical factor governing crop growth.* ESA

N76-11815* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRICULTURE, FORESTRY, RANGE, AND SOILS, CHAPTER 2, PART C
In its Active Microwave Workshop Report 1975 p 97-126

CSCL 08B

The feasibility of using microwave systems in agriculture, forestry, range, and soil moisture measurements was studied. Theory and preliminary results show the feasibility of measuring moisture status in the soil. For vegetational resources, crop identification for inventory and for yield and production estimates is most feasible. Apart from moisture- and water-related phenomena, microwave systems are also used to record structural and spatial data related to crops and forests. E.H.W.

N76-12426*# California Univ., Berkeley. Space Sciences Lab.
REGIONAL AGRICULTURAL SURVEYS USING ERTS-1 DATA Final Report, 1 Jul. 1972 - 31 Dec. 1974
Robert N. Colwell and Andrew S. Benson, Principal Investigators 31 Dec. 1974 194 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E76-10037; NASA-CR-145580; SSL-Ser-16-Issue-50) Avail: NTIS HC $7.50 CSCL 02C

N76-12446*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
MICROWAVE REMOTE SENSING OF SOIL WATER CONTENT
Josef Cihlar and Fawwaz T. Ulaby Aug. 1975 196 p refs
(Contract NAS9-14052)
(NASA-CR-144577; RSL-TR-264-6) Avail: NTIS HC $7.50 CSCL 08M

Microwave remote sensing of soils to determine water content was considered. A layered water balance model was developed for determining soil water content in the upper zone (top 30 cm), while soil moisture at greater depths and near the surface during the diurnal cycle was studied using experimental measurements. Soil temperature was investigated by means of a simulation model. Based on both models, moisture and temperature profiles of a hypothetical soil were generated and used to compute microwave soil parameters for a clear summer day. The results suggest that, (1) soil moisture in the upper zone can be predicted on a daily basis for 1 cm depth increments, (2) soil temperature presents no problem if surface temperature can be measured with infrared radiometers, and (3) the microwave response of a bare soil is determined primarily by the moisture at and near the surface. An algorithm is proposed for monitoring large areas which combines the water balance and microwave methods. Author

N76-12454*# Lockheed Electronics Co., Houston, Tex.
CROP IDENTIFICATION TECHNOLGY ASSESSMENT FOR REMOTE SENSING (CITARS). VOLUME 1: TASK DESIGN PLAN
Forrest G. Hall and Robert M. Bizzell Feb. 1975 284 p
(Contract NAS9-12200)
(NASA-CR-144571; LEC-4326A-Vol-1; JSC-09384-Vol-1) Avail: NTIS HC $9.25 CSCL 02C

A plan for quantifying the crop identification performances resulting from the remote identification of corn, soybeans, and wheat is described. Steps for the conversion of multispectral data tapes to classification results are specified. The crop identification performances resulting from the use of several basic types of automatic data processing techniques are compared and examined for significant differences. The techniques are evaluated also for changes in geographic location, time of the year, management practices, and other physical factors. The results of the Crop Identification Technology Assessment for Remote Sensing task will be applied extensively in the Large Area Crop Inventory Experiment. Author

N76-13470# Maryland Univ., College Park. Computer Science Center.
A COMPARATIVE STUDY OF TEXTURE MEASURES FOR TERRAIN CLASSIFICATION
Joan S. Weszka and Azriel Rosenfeld Mar. 1975 67 p refs
(Contract F44620-72-C-0062)
(AD-A012905; TR-361) Avail: NTIS CSCL 09/2

Three standard approaches to automatic texture classification make use of features based on the Fourier power spectrum, on gray level co-occurrences, and on statistics of local properties, respectively. In this paper, features of these types are applied to a set of 54 picture samples taken from aerial photographs of nine terrain types (Lake, Marsh, Orchard, Railroad, Scrub, Suburb, Swamp, Urban, and Woods). Classification results are compared for individual features and pairs of features within each feature class. In general, the Fourier based features performed poorest, while those based on statistics of gray level differences performed best. GRA

N76-13546*# Alaska Univ., Fairbanks. Alaska Cooperative Wildlife Research Unit.
USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EAST CENTRAL ALASKA Progress Report
Peter C. Lent, Principal Investigator 1 Nov. 1975 19 p ref ERTS
(Contract NAS5-20915)
(E76-10059; NASA-CR-145751; PR-2) Avail: NTIS HC $3.50 CSCL 06C

The author has identified the following significant results. Two scenes were analyzed by applying an iterative cluster analysis to a 2% random data sample and then using the resulting clusters as a training set basis for maximum likelihood classification. Twenty-six and twenty-seven categorical classes, respectively resulted from this process. The majority of classes in each case were quite specific vegetation types; each of these types has specific value as moose habitat.

N76-13552*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Oct. 1975
David S. Gilmer, Principal Investigator Oct. 1975 2 p EREP
(NASA Order T-4114-B; Contract DI-14-16-0008-802)
(E76-10065; NASA-CR-145757) Avail: NTIS HC $3.50 CSCL 06C

N76-13556*# Geological Survey, Reston, Va.
[GROUND TRUTH DATA FROM ARIZONA AND MONTANA TEST SITES] Progress Report
Gordon Bentley, Principal Investigator [1975] 3 p ERTS
(Contract NAS5-3966)
(E76-10069; NASA-CR-145761) Avail: NTIS HC $3.50 CSCL 05B

N76-13564*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
JOINT SOIL MOISTURE EXPERIMENT (JSME) SCATTEROMETER SYSTEMS
S. C. Reid Oct. 1975 34 p
(Contract NAS9-12200)
(NASA-CR-144570; LEC-7195; JSC-10634) Avail: NTIS HC $4.00 CSCL 08M

Specifications are given for the 400 MHz, the 1.6 GHz, and 13.3 GHz scatterometers used in the Joint Soil Moisture Experiment. Author

N76-13585# Naval Surface Weapons Center, Dahlgren, Va.
TERRAIN MAPPING AND LINE-OF-SIGHT PROGRAMS. PROGRAM MAINTENANCE MANUAL
David K. Jefferson Jul. 1975 107 p refs
(AD-A013217; NSWC/DL-TR-3339) Avail: NTIS CSCL 08/2

The terrain mapping programs perform the functions of transforming a numerical map data file, produced by the Defense Mapping Agency on a UNIVAC 1108, into a printed array of elevations or into a file suitable for processing by the line-of-sight programs. The line-of-sight programs may be used to produce map overlays, indicating which areas are visible and which are hidden from some specified observation point, or to interactively determine whether a point is visible from another point. All programs run on the CDC 6000 series computer system using the SCOPE 3.3 operating system. Author (GRA)

N76-13669*# Kanner (Leo) Associates, Redwood City, Calif.
SIMULATION STUDIES OF THE SHF RADIATION CHARACTERISTICS OF SOILS UNDER MOIST CONDITIONS
A. Ye. Basharinov and A. M. Shutko Washington NASA Aug. 1975 56 p refs Transl. into ENGLISH of "Modelnyye Issledovaniya SVCh Radiatsionnykh Kharacteristik Pochvo-Gruntov v Usloviyakh Uvlazhneniya" (unpublished report) Moscow, Acad. of Sci. of the USSR, Inst. of Radio Eng. and Electronics, 1975 p 1-81
(Contract NASw-2790)
(NASA-TT-F-16489) Avail: NTIS HC $4.50 CSCL 08M

Materials for model studies of the radiation characteristics of soils in the SHF band are presented. The influence of the heterogeneous distribution of moisture through the depth of the medium, plant cover, surface irregularities and temperature variations in the surface layer on the characteristics of the natural radiation spectrum was studied. The accuracy and depth of moisture probing by spectral radiothermal measurements were also estimated. Author

N76-14562*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Final Report
William G. Hart, Principal Investigator, Sammy J. Ingle, and M. R. Davis [1975] 30 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4109-B)
(E76-10079; NASA-CR-144483) Avail: NTIS HC $4.00 CSCL 02C

The author has identified the following significant results. With comparative observations of film types and seasonal influences on reflectance characteristics, many crop varieties can be identified. This study shows that citrus, sugar cane, brush, some winter vegetables, and grain crops could be identified. Vegetative patterns in border areas can be detected. This information can be useful in detecting avenues of entry of pest species and areas of stress that require vigilance in stopping the spread of destructive species. Influence of some environmental factors on crops that may be confused with pest injury, or related factors, can be detected and identified with Skylab data (S-190B).

N76-14569*# Minnesota Univ., Minneapolis. Space Science Center.
A STUDY OF MINNESOTA FORESTS AND LAKES USING DATA FROM EARTH RESOURCES TECHNOLOGY SATELLITES Progress Report
30 Jun. 1975 75 p refs Original contains color illustrations
(Grant NGL-24-005-263)
(NASA-CR-145904) Avail: NTIS HC $4.50 CSCL 08B

ERTS and Landsat images were used to study water quality and turbidity around St. Paul-Minneapolis metropolitan area. Sediments were also investigated in the same area. In northeastern Minnesota north of Lake Superior, the intercontinental rift was examined, along with large, low grade, copper-nickel deposits.

N76-14574*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
SOIL MOISTURE DETECTION FROM RADAR IMAGERY OF THE PHOENIX, ARIZONA TEST SITE
Josef Cihlar, Fawwaz T. Ulaby, and Raymond Mueller Jun. 1975 40 p refs
(Contract NAS9-14052)
(NASA-CR-144638; RSL-TR-264-4) Avail: NTIS HC $4.00 CSCL 17I

The Environmental Research Institute of Michigan (ERIM) dual-polarization X and L band radar was flown to acquire radar imagery over the Phoenix (Arizona) test site. The site was covered by a north-south pass and an east-west pass. Radar response to soil moisture was investigated. Since the ERIM radar does not have accurately measured antenna patterns, analysis of the L band data was performed separately for each of several strips along the flight line, each corresponding to a narrow angle of incidence. For the NS pass, good correlation between the radar return and mositure content was observed for each of the two nearest (to nadir) angular ranges. At higher angular ranges, no correlation was observed. The above procedure was not applied to the EW pass due to flight path misalignments. The results obtained stress the importance of radar calibration, the digitization process, and the angle of incidence. Author

N76-14575*# Department of Agriculture, Washington, D.C.
NASA CROP CALENDARS: WHEAT, BARLEY, OATS, RYE, SORGHUM, SOYBEANS, CORN
M. R. Stuckey and E. N. Anderson 17 Jan. 1975 93 p refs Sponsored by NASA
(NASA-CR-145956) Avail: NTIS HC $5.00 CSCL 02C

Crop calenders used to determine when Earth Resources Technology Satellite ERTS data would provide the most accurate wheat acreage information and to minimize the amount of ground verified information needed are presented. Since barley, oats, and rye are considered 'confusion crops, i.e., hard to differentiate from wheat in ERTS imagery, specific dates are estimated for these crops in the following stages of development: (1) seed-bed operation, (2) planting or seeding, (3) intermediate growth, (4) dormancy, (5) development of crop to full ground cover, (6) heading or tasseling, and flowering, (7) harvesting, and (8) posting-harvest operations. Dormancy dates are included for fall-snow crops. A synopsis is given of each states' growing conditions, special cropping practices, and other characteristics which are helpful in identifying crops from ERTS imagery.
Author

N76-15528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING (CITARS)
Marvin E. Bauer, Tina K. Cary, Barbara J. Davis, and Philip H. Swain 1975 59 p refs
(Contract NAS9-14016)
(NASA-CR-147389; LARS-Inform-Note-07215) Avail: NTIS HC $4.50 CSCL 02C

The results of classifications and experiments performed for the Crop Identification Technology Assessment for Remote Sensing (CITARS) project are summarized. Fifteen data sets were classified using two analysis procedures. One procedure used class weights while the other assumed equal probabilities of occurrence for all classes. In addition, 20 data sets were classified using training statistics from another segment or date. The results of both the local and non-local classifications in terms of classification and proportion estimation are presented. Several additional experiments are described which were performed to provide additional understanding of the CITARS results. These experiments investigated alternative analysis procedures, training set selection and size, effects of multitemporal registration, the spectral discriminability of corn, soybeans, and other, and analysis of aircraft multispectral data.
Author

N76-15533*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE USE OF ERTS-1 MULTISPECTRAL IMAGERY FOR CROP IDENTIFICATION IN A SEMI-ARID CLIMATE
John G. Stockton, Marvin E. Bauer, Byron O. Blair, and Marion F. Baumgardner 1975 55 p refs
(Contracts NAS5-21785; NAS9-14016)
(NASA-CR-147405; LARS-Inform-Note-040775) Avail: NTIS HC $4.50 CSCL 02C

Crop identification using multispectral satellite imagery and multivariate pattern recognition was used to identify wheat accurately in Greeley County, Kansas. A classification accuracy of 97 percent was found for wheat and the wheat estimate in hectares was within 5 percent of the USDA's Statistical Reporting Service estimate for 1973. The multispectral response of cotton and sorghum in Texas was not unique enough to distinguish between them nor to separate them from other cultivated crops.
Author

02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A76-10069 # **An experiment in tropical mesoscale analysis. I, II.** C. L. Smith, S. M. Daggupaty, L. Sapp (National Center for Atmospheric Research, Boulder, Colo.), and E. J. Zipser. *Monthly Weather Review,* vol. 103, Oct. 1975, p. 878-903. 20 refs.

Part I of the paper presents combined rawinsonde, radar, ocean vessel, aircraft and geostationary satellite observations - in the context of the Barbados Oceanographic and Meteorological Experiment (BOMEX) - of a strong mesoscale cyclone with a lifetime of less than 12 h within a synoptic scale wave. Part II is devoted to a computational scheme for the scale interaction between the cyclone and the large scale wave, with emphasis on the divergence, vertical motion and mass flux calculations. B.J.

A76-10982 # **Forecasting extratropical storms with hurricane intensity using satellite information.** H. Böttger, M. Eckardt, and U. Katergiannakis (Berlin, Freie Universität, Berlin, West Germany). *Journal of Applied Meteorology,* vol. 14, Oct. 1975, p. 1259-1265. Research supported by the Deutsche Forschungsgemeinschaft and Freie Universität Berlin.

A76-11392 **Measurements of ozone and minor atmospheric constituents.** B. Carli, D. H. Martin, E. Puplett (Queen Mary College, London, England), and J. E. Harries (Aeronautical Research Council, National Physical Laboratory, Teddington, Middx., England). *Nature,* vol. 257, Oct. 23, 1975, p. 649.

An absolute spectrometric radiometer was used in the studies. Appreciable atmospheric water vapor was found at the altitude of the employed aircraft (up to about 39,000 feet). Constant elevation was maintained during the recording of an interferogram. More than 100 interferograms were recorded. Parts of two of the emission spectra are presented in a graph. G.R.

A76-11688 # **Mean seasonal cloud distribution obtained by satellite photographs and correlation between cloud cover and surface pressure over Europe and the Atlantic.** H. Malberg (Berlin, Freie Universität, Berlin, West Germany). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 241, 243-254. 8 refs.

A76-12283 # **Satellite derived inferences to some characteristics of the South Pacific atmospheric circulation associated with the Niño event of 1972-73.** N. A. Streten (Australian Numerical Meteorology Research Centre, Melbourne, Australia). *Monthly Weather Review,* vol. 103, Nov. 1975, p. 989-995. 13 refs.

A76-12397 * # **Directional-cosine and related pre-processing techniques - Possibilities and problems in earth-resources surveys.** F. Quiel (Karlsruhe, Universität, Karlsruhe, West Germany). *ESA Scientific and Technical Review,* vol. 1, no. 1, 1975, p. 1-21. 8 refs. Contract No. NAS9-13380; Grant No. NGL-15-005-112.

The possibilities of using various pre-processing techniques (directional-cosine, ratios and ratio/sum) have been investigated in relation to an urban land-use problem in Marion County, Indiana (USA) and for geologic applications in the San Juan Mountains of Colorado. For Marion County, it proved possible to classify directional-cosine data from September 1972 into different land uses by applying statistics developed with data from a May 1973 ERTS frame, thereby demonstrating the possibilities of using this type of data for signature-extension purposes. In the Silverton (Colorado) area pre-processed data proved superior to original data when extracting useful information in mountainous areas without corresponding ground observations. This approach allowed meaningful classification and interpretation of the data. The main problems encountered as a result of atmospheric effects, mixing of different surface materials, and the performance characteristics of ERTS are elucidated. (Author)

A76-14556 **A gas sampling and static reactor system for use in evaluating the environmental fate of volatile chemicals from industrial processes at trace levels - Application to volatile inorganic hydrides as used in the semiconductor industry.** E. J. Sowinski (Western Electric Co., Allentown, Pa.) and E. H. Suffet (Drexel University, Philadelphia, Pa.). In: Advances in test measurement. Volume 12 - Proceedings of the Twenty-first International Instrumentation Symposium, Philadelphia, Pa., May 19-21, 1975. Pittsburgh, Pa., Instrument Society of America, 1975, p. 463-466. 10 refs.

This paper reports the development of an experimental laboratory system for identifying potentially toxic volatile byproducts from an industrial process and for characterizing their airborne stability at trace levels. The system has been applied in an exemplary manner to the analysis and fate of volatile inorganic hydrides. The heart of the system consists of a static reactor to which can be added pyrolysis products from a flow reactor, or other reactants. The static reactor can be resampled at any time. Methods for identifying and quantitating pyrolysis products by chromatography with multiple detectors and mass spectroscopy are included. (Author)

A76-14837 * **Satellite microwave observations of the Utah Great Salt Lake Desert.** F. T. Ulaby, L. F. Dellwig (University of Kansas Remote Sensing Laboratory, Lawrence, Kan.), and T. Schmugge (NASA, Goddard Space Flight Center, Hydrology and Oceanography Branch, Greenbelt, Md.). *Radio Science,* vol. 10, Nov. 1975, p. 947-963. 19 refs.

Microwave data acquired over the Great Salt Lake Desert area by sensors aboard Skylab and Nimbus 5 indicate that the microwave emission and backscatter were strongly influenced by contributions from subsurface layers of sediment saturated with brine. This phenomenon was observed by Skylab's S-194 radiometer operating at 1.4 GHz, S-193 RADSCAT (Radiometer-Scatterometer) operating at 13.9 GHz, and the Nimbus 5 ESMR (Electrically Scanning Microwave Radiometer) operating at 19.35 GHz. The availability of ESMR data over an 18-month period allowed an investigation of temporal variations. (Author)

A76-15414 **Study of laser radar system using the differential absorption method for detection of air pollutants.** H. Inomata and T. Igarashi (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Japan). *Japanese Journal of Applied Physics,* vol. 14, Nov. 1975, p. 1751-1760. 15 refs. Research supported by the Environmental Agency.

A laser radar system using the differential absorption method for remote measurement of atmospheric NO2 and SO2 is studied. A simultaneous two-wavelength dye laser for the transmitter and a simultaneous two-wavelength signal processer for the receiver are developed. In using this technique, one laser shot allows the determination of NO2 concentrations with an uncertainty equivalent to 44 ppm times the range interval (in meters). It seems that the technique is most promising for a range-resolved measurement of ambient molecular pollutants, since it has the advantage of cancelling the effect of atmospheric variation in a measurement when atmospheric aerosols are used as a distributed reflector. (Author)

A76-15455 Surveillance of the Missouri River Basin using remote sensing. J. H. Senne (Missouri, University, Rolla, Mo.). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974.
Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 233-246.

Proper management of the Missouri River and the adjacent flood-plain area is an important aspect of energy conservation. Remote sensing, which is essentially a data-gathering tool, is being used to monitor certain aspects of the river and to identify environmental changes. This includes identification of vegetation adjacent to it, sediment concentrations carried by the river and its tributaries, sources of pollution, recreation sites, urban and industrial expansion, and assistance in flood-plain management. ERTS and SKYLAB imagery, along with U-2, RB-57, and low-altitude flights, have all produced useful data for this monitoring process. (Author)

A76-15675 Applications of remote sensing to the study of the biosphere (Applications de la télédétection à l'étude de la biosphère). C. M. Girard and M. C. Girard (Institut National Agronomique Paris-Grignon, Paris, France). Paris, Masson et Cie., Editeurs, 1975. 200 p. 237 refs. In French. $21.50.

The present work deals with recent advances in remote sensing which require the development of improved interpretation techniques, along with the characterization of vegetation and soils, treatment of data, agronomical mapping, and human impact on the environment. Particular attention is given to the methodology of photo-interpretation as related to aerial survey and interpretation of imagery. Examples on the treatment of data on high-altitude imagery are presented. S.D.

A76-15768 # Recent developments in environmental sensing with the Barringer Correlation Spectrometer. J. H. Davies, N. D. van Egmond, R. Wiens, and H. Zwick (Barringer Research, Ltd., Rexdale, Ontario, Canada; Rijks Instituut voor de Volksgezondheid, Rijks, Netherlands). *(Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Canada, Feb. 4, 5, 1975.) Canadian Journal of Remote Sensing,* vol. 1, Nov. 1975, p. 85-94. 8 refs. Research supported by the Canadian Department of Industry, Trade and Commerce and Rijks Instituut voor de Volksgezondheid.

The Barringer Correlation Spectrometer (COSPEC) detects gaseous pollutants by cross-correlating a portion of the incoming absorption spectrum of the target gas against a stored replica of the spectrum, consisting of a series of exit slits concentrically inscribed on a rotating disc spinning in the exit plane of a conventional folded Ebert spectrometer. The instrument may be used in three modes for airborne profiling. The downward-looking mode utilises sunlight reflected upwards from the earth. The upward-looking mode uses the Rayleigh backscattered light from the overhead atmosphere. In the ambient mode the COSPEC views horizontally along an optical path beamed around the aircraft from an active light source. Results of studies using the COSPEC in airborne applications are discussed.
C.K.D.

A76-15769 # Laser induced spectral signatures of relevance to environmental sensing. R. M. Measures, W. R. Houston, D. G. Stephenson (Toronto, University, Toronto, Canada), and J. Garlick. *(Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Canada, Feb. 4, 5, 1975.) Canadian Journal of Remote Sensing,* vol. 1, Nov. 1975, p. 95-102. 15 refs. Research supported by the Department of Energy, Mines and Resources, National Research Council, and Defence Research Board of Canada.

Laser fluorosensors represent an exciting new form of remote sensor capable of performing spectral analysis at a distance. Our recent discovery of the fluorescence decay spectrum offers to considerably enhance the identification capability of these instruments, while our study of water fluorescence suggests that the laser fluorosensor could be used to remotely monitor certain aspects of water quality. (Author)

A76-16112 * The effect of atmospheric haze on images of the earth's surface. A. P. Odell (Northern Iowa, University, Cedar Falls, Iowa) and J. A. Weinman (Wisconsin, University, Madison, Wis.). *Journal of Geophysical Research,* vol. 80, Dec. 20, 1975, p. 5035-5040. 11 refs. NSF Grant No. GA-31562; Grant No. NsG-1057.

The adding method to solve the equation of radiative transfer has been applied to a sunlit haze above a reflecting surface. The method was modified to include the effect of inhomogeneities on the underlying surface whose dimensions are less than the mean free path of the photons in the haze. Numerical examples of surface-feature contrast degradation due to haze are presented. This analysis renders it feasible to determine the optical thickness of hazes from haze-degraded images of the ground and also provides a technique to restore ground-image contrast, which has been obscured by haze, in photoelectrically scanned images. (Author)

A76-17099 # Investigations of strong valley winds in Alaska using satellite infrared imagery. S. Marvill and K. O. L. F. Jayaweera (Alaska, University, Fairbanks, Alaska). *Monthly Weather Review,* vol. 103, Dec. 1975, p. 1129-1136. 10 refs. Grant No. NOAA-5-35190.

During the Alaskan cold season, the extreme low temperatures that prevail in the interior valleys are significantly modified by valley wind episodes. The infrared sensor on the NOAA polar orbiting satellite clearly detects this warming and delineates the exact area covered by valley winds. Satellite IR images were used in conjunction with surface and upper air maps, radiosonde data, and pilot reports to analyze two valley wind episodes during early 1975. Clear weather allowed excellent satellite viewing and strong temperature contrasts, because of strong radiational cooling in non-windy valley locations. In both cases a high-amplitude 500 mb ridge was moving into the interior from the west with a strong surface high centered east of the windy area. The strength of the surface wind correlated well with the strength of the surface pressure gradient parallel to the valleys. The wind originated in the narrow sections of the valleys and consistently gusted to 45 kt in the Tanana Valley. The ability of the satellite to view these areas of warming and associated turbulence will alert forecasters to valley wind episodes where there are no conventional surface observations or pilot reports. (Author)

A76-17678 Diurnal variations of radar backscatter from a vegetation canopy. F. T. Ulaby and P. P. Batlivala (University of Kansas Center for Research, Inc., Lawrence, Kan.). *IEEE Transactions on Antennas and Propagation,* vol. AP-24, Jan. 1976, p. 11-17. 12 refs.

The backscattering coefficients of four densely planted fields of sorghum with different combinations of surface roughness and plant height were measured using a radio spectrometer mounted on a 20 m boom. Data were collected at various frequencies between 2 and 8 GHz, 2 polarizations (HH, VV) and 6 incidence angles (0 to 50 deg from nadir in 10 deg steps). Analysis of the scattering data indicates no apparent sensitivity to soil moisture variation. The backscattering coefficient displayed a definite diurnal pattern of variation, which appeared to be sensitive to frequency and incidence angle but which was unaffected by the polarization. C.K.D.

A76-18413 # Possibilities of determining the atmospheric N2O and CH4 content by interpreting measurements of the spectral-angular structure of thermal radiation (O vozmozhnostiakh opredeleniia soderzhaniia N2O i CH4 v atmosfere na osnove interpretatsii izmerenii spektral'no-uglovoi struktury teplovogo izlucheniia). V. V. Rozanov and Iu. M. Timofeev (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol. 11, Oct. 1975, p. 1066-1069. 9 refs. In Russian.

A76-18799 # Monitoring of pollutant gases in aircraft exhausts by gas-filter correlation methods. D. A. Gryvnak and D. E.

Burch (Aeronutronic Ford Corp., Newport Beach, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 14th, Washington, D.C., Jan. 26-28, 1976, Paper 76-110.* 11 p. 14 refs. USAF-supported research.

An infrared instrument using a gas-filter correlation technique was used to monitor NO and CO by looking across the exhaust plume of a T56 jet engine combustor. The instrument, built previously by Aeronutronic Ford for EPA to monitor pollutant gases in smokestack exhausts, was modified for use on the combustor. Temperatures and concentrations ranged from 300 to 930 K and up to 130 ppm for NO, and from 300 to 550 K and up to 220 ppm for CO. The infrared results compared reasonably well with results that were obtained simultaneously by withdrawing the sample using probe techniques and analyzing the gas with a conventional gas analyzer. (Author)

N76-10349 Stanford Univ., Calif.
SECOND ORDER ELECTROMAGNETIC AND HYDRODYNAMIC EFFECTS IN HIGH FREQUENCY RADIO WAVE SCATTERING FROM THE SEA Ph.D. Thesis
Donald LeRoy Johnstone 1975 244 p
Avail: Univ. Microfilms Order No. 75-21877

A theoretical analysis of high-frequency radio-wave scattering form the sea establishes relationships between the Doppler continuum of observed radar echoes and the heights and propagation directions of ocean-surface waves. Techniques are presented for the remote sensing of sea-surface conditions by either monostatic or bistatic radars. Doppler spectra calculated from model ocean wave-height directional spectra agree generally in shape, power content, and occurrence of swell with data from radar and oceanographic measurements. It is concluded that second-order effects and double Bragg-scattering are responsible for most of the features in the continuum of Doppler spectra of radar echoes from the sea. Parameters for estimating wind speed and direction, based on the variations of radar cross section with these conditions, are consistent with the available expermental data. Dissert. Abstr.

N76-10536*# Mississippi State Office of Science and Technology, Jackson.
APPLICATION AND EVALUATION OF SATELLITE REMOTE SENSING DATA AND AUTOMATIC PROCESSING TECHNIQUES FOR STATE-WIDE LAND USE AND OTHER RESOURCE MANAGEMENT Progress Report, period ending 21 Jul. 1975
P. T. Bandston, Principal Investigator 21 Jul. 1975 7 p ERTS
(Contract NAS5-20918)
(E76-10004; NASA-CR-119111) Avail: NTIS HC $3.25 CSCL 08B

N76-10537*# Earth Satellite Corp., Washington, D.C.
STUDY OF MESOCALE EXCHANGE PROCESSES UTILIZING LANDSAT AIR MASS CLOUD IMAGERY Interim Report, Jun. - Aug. 1975
Earl S. Merritt, Principal Investigator Sep. 1975 7 p ERTS
(Contract NAS5-20944)
(E76-10005; NASA-CR-119113) Avail: NTIS HC $3.25 CSCL 04B

N76-10538*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
PHOTOINTERPRETATION OF SKYLAB PHOTOGRAPHY Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, H. W. Weeden, C. Kleeman, S. Daelhausen, and G. Hesler Aug. 1975 26 p refs EREP
(Contract NAS9-13406)
(E76-10006; NASA-CR-119114; ORSER-SSEL-TR-16-75) Avail: NTIS HC $3.75 CSCL 05B

The author has identified the following significant results. In terms of film grain texture and object definition, the S190B color positive film is distinctly superior to the S190A films, when both are compared in the 9 x 9 inch format. Within the six S190A films, the panchromatic black and white films are superior to the infrared black and white, and the color positive film is superior to the color infrared. Minimum relief differences on the order of 500 to 100 feet could be detected by stereoscopic study, however, it is not possible to determine to what extent vegetation and cultural practices assist in such delineations. Water and wind gaps through major ridges were easily seen. Streams of third order and larger were clearly visible and easy to trace; second order streams were not identified with consistency. Differences in color, tone, and textural patterns rarely supplied clues for differentiating soils or bedrock. The separation of naturally forested areas from areas of cultivation and pasture was effective and a valuable clue to the underlying geology. Suburban and industrial developments were clearly differentiated from urban areas and surrounding agricultural fields. Soil associations could be identified on a regional basis, but no sharp boundary could be drawn separating soil associations.

N76-10550*# Department of Mines and Geology, Maseru (Lesotho).
USE OF ERTS IMAGERY FOR NATURAL RESOURCES RESEARCH AND DEVELOPMENT IN LESOTHO Final Report, Sep. 1972 - May 1974
P. H. Nixon, Principal Investigator and A. A. Jackson May 1974 23 p refs Sponsored by NASA ERTS
(E76-10018; NASA-CR-119126; SR-F515) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. As far as the geological aspects of the project were concerned, the project was a success. It was concluded that: (1) It is possible to trace the lithological boundaries between sedimentary rocks and basaltic rocks, both extrusive and intrusive. (2) It was possible to localize sponges in the mountain areas, some of which may conceal undiscovered diamond pipes. (3) Possible main structural axes were localized within the framework of lineaments. Due to drought which occured at the time the images were gathered by ERTS-1, the usefulness of the data was limited for agricultural purposes.

N76-10551*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Annual Progress Report
Robert N. Colwell, Principal Investigator 1 May 1975 619 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-05-003-404)
(E76-10019; NASA-CR-119127; SSL-Ser-16-Issue-34) Avail: NTIS HC $15.25 CSCL 08F

The author has identified the following significant results. A weighted stratified double sample design using hardcopy LANDSAT-1 and ground data was utilized in developmental studies for snow water content estimation. Study results gave a correlation coefficient of 0.80 between LANDSAT sample units estimates of snow water content and ground subsamples. A basin snow water content estimate allowable error was given as 1.00 percent at the 99 percent confidence level with the same budget level utilized in conventional snow surveys. Several evapotranspiration estimation models were selected for efficient application at each level of data to be sampled. An area estimation procedure for impervious surface types of differing impermeability adjacent to stream channels was developed. This technique employs a double sample of 1:125,000 color infrared hightflight transparency data with ground or large scale photography.

N76-10552*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A RADIATIVE TRANSFER MODEL FOR MICROWAVE EMISSIONS FROM BARE AGRICULTURAL SOILS
William J. Burke and Jack F. Paris (Lockheed Electronics Co.)

Aug. 1975 29 p refs
(NASA-TM-X-58166; JSC-09836) Avail: NTIS HC $3.75 CSCL 08M

A radiative transfer model for microwave emissions from bare, stratified agricultural soils was developed to assist in the analysis of data gathered in the joint soil moisture experiment. The predictions of the model were compared with preliminary X band (2.8 cm) microwave and ground based observations. Measured brightness temperatures at vertical and horizontal polarizations can be used to estimate the moisture content of the top centimeter of soil with + or - 1 percent accuracy. It is also shown that the Stokes parameters can be used to distinguish between moisture and surface roughness effects. Author

N76-10558*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE MICROWAVE OBSERVATIONS OF THE UTAH GREAT SALT LAKE DESERT
Fawwaz T. Ulaby (Kansas Univ. Center for Res.), Louis F. Dellwig (Kansas Univ. Center for Res.), and Thomas Schmugge Oct. 1975 41 p refs Submitted for publication
(NASA-TM-X-71000; X-913-75-252) Avail: NTIS HC $3.75 CSCL 08G

Microwave data acquired over the Great Salt Lake Desert by sensors aboard Skylab and Nimbus 5 indicate that microwave emission and backscatter were strongly influenced by contributions from subsurface layers of sediment saturated with brine. This phenomenon was observed by Skylab's S-194 radiometer operating at 1.4 GHz, S-193 RADSCAT (Radiometer-Scatterometer) operating at 13.9 GHz and the Nimbus 5 ESMR (Electrically Scanning Microwave Radiometer) operating at 19.35 GHz. The availability of ESMR data over an 18 month period allowed an investigation of temporal variations. Aircraft 1.4 GHz radiometer data acquired two days after one of the Skylab passes confirm the satellites observations. Data from the ESMR revealed similar responses over the Bolivian deserts, which have geologic features similar to those of the Utah desert. Author

N76-10579*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
CARBON MONOXIDE POLLUTION EXPERIMENT Final Report
M. H. Bortner, R. Dick (Barringer Res., Ltd.), H. W. Goldstein, and R. N. Grenda Jan. 1975 192 p refs
(Contract NAS1-10139)
(NASA-CR-132717) Avail: NTIS HC $7.00 CSCL 13B

The experiment is designed to obtain data for the investigation of mechanisms by which CO is removed from the earth's atmosphere. The approach uses an orbiting platform to remotely map global CO concentrations and determine vertical CO profiles using a correlation interferometer measurement technique. The instrument is capable of measuring CO over the range of expected atmospheric burdens and of measuring trace atmospheric constituents. Author

N76-10600# Virginia Inst. of Marine Science, Gloucester Point.
DETERMINATION OF THE LEEWAY OF OIL SLICKS Final Report
Craig L. Smith Aug. 1974 47 p refs
(Contract DOT-CG-33183-A)
(AD-A006822; VIMS-Contrib-644; USCG-d-60-75; CGR/DC-30/74) Avail: NTIS CSCL 13/2

The leeway of oil slicks was determined as a function of wind velocity in the range 5-25 knots to enable more precise forecasting of the trajectory of oil spills, and thus aid effective containment and cleanup operations. Leeway was calculated by measurement of the separation of oil slicks from a dyed patch of surface water at sea, using time-sequenced nadir aerial photography. Five oil types, Nos. 2, 4, and 6 fuel oils, and light and heavy crude oils, were found to exhibit similar leeway as a function of wind speed. Oil spill volume had not measureable effect on leeway, and slicks moved in the direction of the wind. The leeway increases with sea state, and obeys a linear relationship with wind velocity in the wind range studies. GRA

N76-11494* National Center for Atmospheric Research, Boulder, Colo.
SATELLITE OBSERVATIONS OF WEATHER AND CLIMATE
William W. Kellogg. *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 74-78 refs
CSCL 04B

The SEASAT-A program is viewed as a new way to obtain atmospheric observations for weather and climatic studies in the framework of the Global Atmospheric Research Program (GARP). Total information derived from SEASAT-A sensor package provides a synoptic picture of the upper parts of the world's oceans as a prerequisite to the development of dynamic ocean models and combined ocean/atmospheric models for weather forecasting requirements. G.G.

N76-11511 Joint Publications Research Service, Arlington, Va.
GEOGRAPHIC PROBLEMS AND THE POSSIBILITIES OF THEIR SOLUTION BY AEROSPACE METHODS
S. V. Zonn *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 16-23 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 8 p

The principal geographic problems are discussed: (1) conservation and rational exploitation of the earth's natural resources as the basis for human life; (2) determination of multisided interaction between modern society and environment and the intensity of man's effect on nature; and (3) prediction of the state of the earth's reproducible resources and different kinds of severe natural phenomena. Visual interpretation, instrumental processing, and visual-instrumental approach are used to study remote sensor results. Agriculture and geomorphology are studied on spaceborne photography. J.A.M.

N76-11515 Joint Publications Research Service, Arlington, Va.
USE OF MATERIALS FROM SPACE SURVEY FOR COMPILING AND REVISING GENERAL GEOGRAPHIC AND SPECIAL MAPS
Yu. G. Kelner and G. N. Romankevich *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 49-54 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p

Topographic map revision and development of new types of cartographic documents are considered, using satellite observation data. The decrease in work due to the space surveys is shown graphically for compilation and editing of general and thematic maps. J.A.M.

N76-11516 Joint Publications Research Service, Arlington, Va.
USE OF MULTIZONAL SPACE SURVEYS IN GEOGRAPHIC RESEARCH AND SPECIAL MAPPING
V. I. Kravtsova *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 55-76 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 22 p

Soyuz-12 data were used to study oceanography, hydrology, soils, geology, forests, geography, and meteorology. Salinization of soil forming rocks, image density of sands and solonchaks, shallow water, turbid water, underwater relief, and solar radiation penetration into sea water are presented in graphic form. J.A.M.

N76-11520*# Brevard County Planning Dept., Titusville, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 May - 11 Aug. 1975
John W. Hannah (NASA. Kennedy Space Center), Garland L.

Thomas, Fernando Esparza, Principal Investigators, and James J. Millard (NASA. Kennedy Space Center) 11 Aug. 1975 24 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20907)
(E76-10022; NASA-CR-145415; BCPD-L2-2) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. St. Johns National Wildlife Refuge, a 4000 acre marsh, was established primarily to protect the Dusky Seaside Sparrow. A vegetation map of the refuge based on ground observations and color infrared photography was made. The preferred habitat of this sparrow is high-to-medium density spartina (a marsh grass) with no trees nearby. An increase in spartina density corresponds to an increase in marsh wetness. A thematic map shows the birds habitat preferences.

N76-11529*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
EARTH RESOURCES EVALUATION FOR NEW MEXICO BY LANDSAT-2 Progress Report, 1-31 Aug. 1975
Karl Vonder Linden, Principal Investigator, Sandra C. Feldman, Michael H. Inglis, Frank E. Kottlowski, and David E. Tabet 31 Aug. 1975 5 p ERTS
(Contract NAS5-20916)
(E76-10031; NASA-CR-145423) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. The Middle Rio Grande project has not yet progressed to the point where mineral exploration sites can be chosen; however, there does appear to be some correlation between the known structure and mineral deposits and the LANDSAT lineament map. A circular feature identified in the southern Magdalena Mountains on LANDSAT-1 imagery agrees well with the location of a newly proposed caldron complex. Several recognized and unrecognized circular features were identified on imagery of the Mogollon-Datil volcanic field. A check of aeromagnetic maps for New Mexico found that the circular features on the LANDSAT imagery showed up as areas of generally high magnetic intensity.

N76-11546*# South Dakota State Univ., Brookings. Remote Sensing Inst.
AERIAL THERMAL SCANNER DATA FOR MONITORING ROOFTOP TEMPERATURES
J. Bjorkland, F. A. Schmer, and R. E. Isakson Nov. 1975 25 p Prepared in cooperation with Central Telephone and Utilities Corp., Lincoln, Nebr.
(Grant NGL-42-003-007)
(NASA-CR-145747; SDSU-RSI-75-11) Avail: NTIS HC $3.50 CSCL 20F

Four Nebraska communities and one South Dakota community were surveyed. Thermal scanner data were converted to a film format and the resultant imagery was successfully employed to monitor rooftop temperatures. The program places emphasis on heat losses resulting from inadequate home insulation, offers CENGAS customers the opportunity to observe a thermogram of their rooftop, and assists homeowners in evaluating insulation needs. Author

N76-11547*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT Annual Report, 1 Jun. 1974 - 31 May 1975
D. S. Lowe, L. B. Istvan, N. E. G. Roller, A. N. Sellman, and T. W. Wagner Sep. 1975 77 p refs
(Grant NGR-23-005-552)
(NASA-CR-145538; ERIM-193400-9-p) Avail: NTIS HC $4.75 CSCL 08B

The utilization of NASA earth resource survey technology as an important aid in the solution of current problems in resource management and environmental protection in Michigan is discussed. Remote sensing techniques to aid Michigan government agencies were used to achieve the following results: (1) provide data on Great Lakes beach recession rates to establish shoreline zoning ordinances; (2) supply technical justification for public acquisition of land to establish the St. John's Marshland Recreation Area; (3) establish economical and effective methods for performing a statewide wetlands survey; (4) accomplish a variety of regional resource management actions in the Upper Peninsula; and (5) demonstrate improved soil survey methods. The project disseminated information on remote sensing technology and provided advice and assistance to a number of users in Michigan. Author

N76-11549*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESULTS OF PHASE ONE OF LAND USE INFORMATION DELPHI STUDY
Charles K. Paul and Albert J. Landini 1 May 1975 36 p
(Contract NAS7-100)
(NASA-CR-145574; JPL-SP-43-22) Avail: NTIS HC $4.00 CSCL 08B

The Land Use Management Information System (LUMIS) is being developed for the city portion of the Santa Monica mountains. LUMIS incorporates data developed from maps and aerial photos as well as traditional land based data associated with routine city and county record keeping activities and traditional census data. To achieve the merging of natural resource data with governmental data LUMIS is being designed in accordance with restrictions associated with two other land use information systems currently being constructed by Los Angeles city staff. The two city systems are LUPAMS (Land Use Planning and Management System) which is based on data recorded by the County Assessor's office for each individual parcel of land in the city, and Geo-BEDS, a geographically based environmental data system. Author

N76-11640# World Meteorological Organization, Geneva (Switzerland).
AGROCLIMATOLOGY OF THE HIGHLANDS OF EASTERN AFRICA
1974 269 p refs Proc. of the FAO/UNESCO/WMO Tech. Conf., Nairobi, Kenya, 1 - 5 Oct. 1973
(WMO-389; ISBN-92-63-10389-5) Avail: NTIS HC $9.00

Lectures and discussions on the basic meteorological characteristics and physical resources of the area, the general circulation and seasonal weather patterns, rain distribution and probabilities, energy budgets, soil characteristics, water budgets, and biometeorological studies of the main crops grown in the area are presented

N76-11648 Food and Agriculture Organization of the United Nations, Rome (Italy).
MEASUREMENTS AND CALCULATIONS OF SOLAR AND NET RADIATION
D. Rijks *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 56-69 refs

Solar radiation and its importance to photosynthesis and crop production is discussed. The components of the radiation balance are noted, and instruments for measuring solar and net radiation are described. Calculations in the absence of measurements are also considered. ESA

N76-11683# National Environmental Satellite Service, Washington, D.C.
A SUMMARY OF THE RADIOMETRIC TECHNOLOGY MODEL OF THE OCEAN SURFACE IN THE MICROWAVE REGION
John C. Alishouse Mar. 1975 31 p refs
(COM-75-10849-8; NOAA-TM-NESS-66; NOAA-75052201) Avail: NTIS HC $4.00 CSCL 08J

Between November 1970 and March 1974, studies were pursued to determine sea-surface temperature and roughness from a satellite-borne microwave radiometer. Such factors as salinity, foam, wave spectra, polarization, and atmospheric attenuation were investigated to determine optimum frequencies and accuracy limitations. The resultant model developed is a two-dimensional two-scale model that incorporates upwind and crosswind wave spectra and considers waves that are both large and small in comparison with the radiometer's wavelength.
GRA

N76-11813* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE REMOTE SENSING OF EARTH/LAND, CHAPTER 2
In its Active Microwave Workshop Report 1975 p 41-67

CSCL 08G
Geoscience applications of active microwave remote sensing systems are examined. Major application areas for the system include: (1) exploration of petroleum, mineral, and ground water resources, (2) mapping surface and structural features, (3) terrain analysis, both morphometric and genetic, (4) application in civil works, and (5) application in the areas of earthquake prediction and crustal movements. Although the success of radar surveys has not been widely publicized, they have been used as a prime reconnaissance data base for mineral exploration and land-use evaluation in areas where photography cannot be obtained.
Author

N76-11816* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LAND USE, URBAN, ENVIRONMENTAL, AND CARTOGRAPHIC APPLICATIONS, CHAPTER 2, PART D
In its Active Microwave Workshop Report 1975 p 126-154 refs
CSCL 08B
Microwave data and its use in effective state, regional, and national land use planning are dealt with. Special attention was given to monitoring land use change, especially dynamic components, and the interaction between land use and dynamic features of the environment. Disaster and environmental monitoring are also discussed.
E.H.W.

N76-11822* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE SENSING OF THE ATMOSPHERE, CHAPTER 4
In its Active Microwave Workshop Report 1975 p 287-337

CSCL 17I
The use of active microwave systems to study atmospheric phenomena is studied. Atmospheric pollution, weather prediction, climate and weather modification, weather danger and disaster warning, and atmospheric processes and interactions are covered.
E.H.W.

N76-11916*# Texas Univ. Health Science Center, Houston. School of Public Health.
REMOTE SENSING UTILITY IN A DISASTER STRUCK URBAN ENVIRONMENT Annual Progress Report, 1 Dec. 1974 - 1 Dec. 1975
Marjorie Rush and Alfonso Holguin 1 Dec. 1975 85 p refs
(Grant NGL-44-084-003)
(NASA-CR-145696) Avail: NTIS HC $5.00 CSCL 06F
Standard operating procedures, utilizing remote sensing, are outlined for public health assistance during natural disaster relief operations. A manual to aid decision making for public health authorities is included. Flow charts which show the procedures that need to be implemented during a natural disaster are also included. Emphasis is placed on a preventive approach to the effects of disasters, and specifically to post-disaster problems that relate to public health concerns during the emergency phase of relief.
J.R.T.

N76-12429*# Arkansas Univ., Fayetteville. Dept. of Geology.
LAND USE CHANGE DETECTION WITH LANDSAT-2 DATA FOR MONITORING AND PREDICTING REGIONAL WATER QUALITY DEGRADATION Quarterly Progress Report, 28 Jul. - 27 Oct. 1975
H. C. MacDonald, Principal Investigator Nov. 1975 10 p ERTS
(Contract NAS5-20810)
(E76-10040; NASA-CR-145626) Avail: NTIS HC $3.50 CSCL 08H

N76-12432*# Bureau of Reclamation, Denver, Colo.
USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM Progress Report, 1 Jul. - 30 Sep. 1975
Archie M. Kahan, Principal Investigator 30 Sep. 1975 5 p ERTS
(NASA Order S-53881-A)
(E76-10043; NASA-CR-145583) Avail: NTIS HC $3.50 CSCL 04B
The author has identified the following significant results. The operation of the LANDSAT data collection system on the Colorado River Basin pilot project during the 1974-75 winter season demonstrated that it is a practical means to obtain accurate data in near real-time to aid in forecasting and control of weather modification operations. Tests of the two prototype wind averaging systems have shown that wind data can be averaged and stored on-site for a period of eight hours prior to transmission through the LANDSAT DCS. These averaged wind data will be much more useful in operational programs than instantaneous values.

N76-12442*# Delaware Univ., Newark. Coll. of Marine Studies.
SPECTRAL REFLECTANCE SIGNATURES OF COASTAL POLLUTANTS
V. Klemas, Principal Investigator, W. Philpot, and G. Davis 6 Oct. 1975 2 p ERTS
(Grant NsG-1149)
(E76-10054; NASA-CR-145594) Avail: NTIS HC $3.50 CSCL 08J

N76-12444*# Delaware Univ., Newark. Coll. of Marine Studies.
VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL
V. Klemas, Principal Investigator, G. Davis, and H. Wang 24 Oct. 1975 2 p ERTS
(Contract NAS5-20983)
(E76-10056; NASA-CR-145596) Avail: NTIS HC $3.50 CSCL 08C
The author has identified the following significant results. LANDSAT, aircraft, ships, and air-dropped current drogues were deployed to determine current circulation and to track oil slick movement on four different dates in Delaware Bay. Results were used to verify a predictive model for oil slick movement and dispersion. The model predicts the behavior of oil slicks given their size, location, tidal stage (current), weather (wind), and nature of crude. Both LANDSAT satellites provided valuable data on gross circulation patterns and convergent coastal fronts which by capturing oil slicks significantly influence their movement and dispersion.

N76-12537# Army Construction Engineering Research Lab., Champaign, Ill.
ENVIRONMENTAL PROTECTION GUIDELINES FOR THE RESIDENT ENGINEER Final Report
Robert E. Riggins May 1975 43 p refs
(DA Proj. 4A1-62121-A896)
(AD-A012109; CERL-TR-E-57) Avail: NTIS CSCL 13/2

This report presents guidelines to assist resident engineers in monitoring compliance with the environmental provisions of construction contracts. It describes general environmental responsibilities of the resident engineer; sources of environmental pollution; techniques for providing environmental protection; and methods of evaluating a construction site for potential environmental problems. GRA

N76-12544# California Univ., Santa Barbara. Marine Science Inst.
OIL SPILL AND OIL POLLUTION REPORTS, NOVEMBER 1974 - FEBRUARY 1975 Quarterly Report
Floyd A. DeWitt, Jr. and Penelope Melvin Cincinnati EPA May 1975 271 p refs
(Contract EPA-R-803063)
(PB-242542/9; EPA-670/2-75-044) Avail: NTIS HC $9.00; HC also available from SOD CSCL 13B

Summaries of oil spill events are presented along with bibliographic literature citations. Current research projects and patents are included. GRA

N76-12629# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
REFRACTION OF SURFACE GRAVITY WAVES IN AN EDDY M.S. Thesis
William Joseph Teague Dec. 1974 103 p refs
(Grant NOAA-04-4-022-24)
(COM-75-10856/3; UMRSMAS-74034) Avail: NTIS MF $5.50 CSCL 08C

The refraction of surface gravity waves by current fields is examined through the use of a geometrical optics approximation. It is found that for realistic mid-ocean eddy structures, significant sea state enhancement may occur well outside the region of circulation. A characteristic signature is associated with the flow pattern, which depends only on the vorticity pattern. The implications of the signature pattern are studied for the exchange of momentum between waves and currents. An estimate of the rate of energy loss through wave breaking indicates that the rate of eddy decay may be significantly affected. The study of signatures has potential in remote sensing by both passive and active microwave techniques. GRA

N76-12634# Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss.
PROCEEDINGS OF THE ALABAMA COASTAL LEADERS CONFERENCE ON COASTAL ZONE MANAGEMENT
30 Apr. 1975 76 p Conf. held at Mobile, Ala., 30 Apr. 1975
(COM-75-10979/3; MASGP-75-012; NOAA-75062012) Avail: NTIS HC $5.00 CSCL 13B

The Alabama Coastal Leaders Conference on Coastal Zone Management was held in Mobile, Alabama, on April 30, 1975. It was the second in a series of meetings on coastal zone management. The conference was designed to help inform the public on the subject of coastal zone management and to obtain suggestions and support for maintaining public involvement. It introduces a future workshop series, where coastal leaders are encouraged to make recommendations for specific provisional policy goals and policy development. GRA

N76-13544*# Wyoming Univ., Laramie. Dept. of Geology.
LAND-USE IN THE MOORCROFT AND KEYHOLE RESERVOIR AREAS, CROOK COUNTY, WYOMING Special Report
Ronald W. Marrs, Principal Investigator Aug. 1975 23 p refs
Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13298)
(E76-10057; NASA-CR-145749) Avail: NTIS HC $3.50 CSCL 08B

N76-13550*# California Univ., Berkeley. Space Sciences Lab.
AN INVENTORY OF IRRIGATED LANDS FOR SELECTED COUNTIES WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report
Robert N. Colwell, Principal Investigator, David M. Huston, and Stephen J. Titus 15 Oct. 1975 25 p refs ERTS
(Contract NAS5-20969)
(E76-10063; NASA-CR-145755; SSL-Ser-16-Issue-56) Avail: NTIS HC $3.50 CSCL 08B

N76-13551*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
COMPUTER MAPPING OF LANDSAT DATA FOR ENVIRONMENTAL APPLICATIONS Special Report
Robert H. Rogers, Principal Investigator, J. B. McKeon, L. E. Reed, N. F. Schmidt, and Roger N. Schecter (Triangle J Council of Governments, Res. Triangle Park, N. C.) Nov. 1975 19 p refs Presented at Workshop for Environ. Applications of Multispectral Imagery, Ft. Belvoir, Va., Nov. 1975 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20942)
(E76-10064; NASA-CR-145756; BSR-4206) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Land cover overlays and maps produced from LANDSAT are providing information on existing land use and resources throughout the 208 study area. The overlays are being used to delineate drainage areas of a predominant land cover type. Information on cover type is also being combined with other pertinent data to develop estimates of sediment and nutrients flows from the drainage area. The LANDSAT inventory of present land cover together with population projects is providing a basis for developing maps of anticipated land use patterns required to evaluate impact on water quality which may result from these patterns. Overlays of forest types were useful for defining wildlife habitat and vegetational resources in the region. LANDSAT data and computer assisted interpretation was found to be a rapid cost effective procedure for inventorying land cover on a regional basis. The entire 208 inventory which include acquisition of ground truth, LANDSAT tapes, computer processing, and production of overlays and coded tapes was completed within a period of 2 months at a cost of about 0.6 cents per acre, a significant improvement in time and cost over conventional photointerpretation and mapping techniques.

N76-13554*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT DATA Progress Report, 1 Aug. - 31 Oct. 1975
M. Griggs, Principal Investigator 1 Nov. 1975 13 p ERTS
(Contract NAS5-20899)
(E76-10067; NASA-CR-145759; SAI-75-666-LJ; PR-3) Avail: NTIS HC $3.50 CSCL 04A

N76-13586*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
LAND USE/VEGETATION MAPPING IN RESERVOIR MANAGEMENT. MERRIMACK RIVER BASIN
H. L. McKim, L. W. Gatto, C. J. Merry, D. M. Anderson, and T. L. Marlar Jul. 1975 23 p
(NASA-CR-145822; AD-A013490; CRREL-SR-233) Avail: NTIS HC $3.50 CSCL 08/6

This report consists of an analysis of: ERTS-1 Multispectral Scanner imagery obtained 10 August 1973; Skylab 3 S190A and S190B photography, track 29, taken 21 September 1973; and RB-57 high-altitude aircraft photography acquired 26 September 1973. These data products were acquired on three cloud-free days within a 47-day period. The objectives of this study were: (1) to make quantitative comparisons between

high-altitude aircraft photography and satellite imagery, and (2) to demonstrate the extent to which high resolution (S190A and B) space-acquired data can be used for land use/vegetation mapping and management of drainage basins. GRA

N76-13643# Environmental Protection Agency, Cincinnati, Ohio.
ACTIVITIES AND NEEDS RELATED TO RADIOACTIVITY STANDARDS FOR ENVIRONMENTAL MEASUREMENTS
James E. Eldridge, ed. (ORNL) and Bernd Kahn, ed. Jun. 1975 62 p refs Symp. held at Washington, D. C., 21 Aug. 1973 (PB-243256/5; EPA-670/4-75-006) Avail: NTIS HC $4.50 CSCL 18K

The need for radioactivity standards in environmental monitoring programs concerned with population radiation exposure was examined. Papers were presented on decay schemes. AEC regulation in the use of radioactivity standards, standards for environmental studies, quality assurance, radionuclide production, and radionuclide metrology and quality assurance. The presentations indicated that numerous radioactivity standards and aids for correctly using them were available. New needs exist, however, because lower levels of ambient radioactivity must be measured by many more groups due to requirements that population radiation exposure from nuclear power production be as low as practicable. The following actions were recommended: (1) establish a focal point for systematically planning activities to *meet cited needs for decay schemes, specific standards, analytical* methods, and quality assurance programs; (2) develop a clear chain of traceability to the National Bureau of Standards; (3) prepare guides for standardizing radiation detection and maintaining quality control; and (4) train qualified analysis to obtain satisfactory analytical results. GRA

N76-14560*# Milan Univ. (Italy).
GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINI *Quarterly Report*
Carlo M. Marino, Principal Investigator 31 Oct. 1975 4 p Sponsored by NASA ERTS
(E76-10077; NASA-CR-145806; QR-1) Avail: NTIS HC $3.50 CSCL 08G

N76-14567*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF COLORADO ROCKY MOUNTAIN ENVIRONMENTS USING ADP TECHNIQUES Final Report, 1 Jul. 1972 - 30 Apr. 1974
Roger M. Hoffer, Principal Investigator 15 Sep. 1974 124 p refs Prepared in cooperation with Colorado Univ., Boulder Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21880)
(E76-10084; NASA-CR-145871; Bull-919; LARS-Inform-Note-061575) Avail: NTIS HC $5.50 CSCL 08B

The author has identified the following significant results. Good ecological, classification accuracy (90-95%) can be achieved in areas of rugged relief on a regional basis for Level 1 cover types (coniferous forest, deciduous forest, grassland, cropland, bare rock and soil, and water) using computer-aided analysis techniques on ERTS/MSS data. Cost comparisons showed that a Level 1 cover type map and a table of areal estimates could be obtained for the 443,000 hectare San Juan Mt. test site for less than 0.1 cent per acre, whereas photointerpretation techniques would cost more than 0.4 cent per acre. Results of snow cover mapping have conclusively proven that the areal extent of snow in mountainous terrain can be rapidly and economically mapped by using ERTS/MSS data and computer-aided analysis techniques. A distinct relationship between elevation and time of freeze or thaw was observed, during mountain lake mapping. Basic lithologic units such as igneous, sedimentary, and unconsolidated rock materials were successfully identified. Geomorphic form, which is exhibited through spatial and textual data, can only be inferred from ERTS data. Data collection platform systems can be utilized to produce satisfactory data from extremely inaccessible locations that encounter very adverse weather conditions, as indicated by results obtained from a DCP located at 3,536 meters elevation that encountered minimum temperatures of -25.5 C and wind speeds of up to 40.9m/sec (91 mph), but which still performed very reliably.

N76-14572* Minnesota Geological Survey, St. Paul.
APPLICATIONS OF ERTS IMAGERY TO MAPPINGS SEDIMENTS OF THE TWIN CITIES METROPOLITAN AREA
J. R. Poppe *In* Minn. Univ. *A study of Minn. Forests and* Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 30 p refs

CSCL 08B

ERTS images were compared to surficial geologic maps, prepared through traditional field studies. Lithologic boundaries, bedrock outcrops, bedrock structures, and geomorphologic features were examined. An area southeast of the Twin Cities, located chiefly in northern Dakota County was studied, as well as the New Brighton 15-minute quadrangle located in portions of Ramsey and Anoka Counties. Visual comparison of geologic maps and ERTS imagery demonstrated the limitations of this approach to geological investigations. Bedrock outcrops and bedrock structure in the metropolitan area do not appear on ERTS imagery. However, certain glacial sediments can be identified and are potentially mappable. Certain geomorphological features were also discernable. J.A.M.

N76-14578*# Lockheed Electronics Co., Houston, Tex.
S193 RADIOMETER BRIGHTNESS TEMPERATURE PRECISION/ACCURACY FOR SL2 AND SL3
D. J. Pounds and K. Krishen Jun. 1975 119 p refs
(Contract NAS9-12200)
(NASA-CR-144572; LEC-5976; JSC-09793) Avail: NTIS HC $5.50 CSCL 20F

The precision and accuracy with which the S193 radiometer measured the brightness temperature of ground scenes is investigated. Estimates were derived from data collected during Skylab missions. Homogeneous ground sites were selected and S193 radiometer brightness temperature data analyzed. The precision was expressed as the standard deviation of the radiometer acquired brightness temperature. Precision was determined to be 2.40 K or better depending on mode and target temperature. Author

N76-14583# Association of American Geographies, Washington, D.C.
USING REMOTE SENSOR DATA FOR LAND USE MAPPING AND INVENTORY: A USER GUIDE Final Interagency Report
Joseph W. Wiedel and Richard Kleckner Jul. 1974 124 p refs
(Contract DI-14-08-0001-13702)
(PB-242813/4; IR-USGS-253; USGS-LI-75-002) Avail: NTIS HC $5.50 CSCL 08B

Various techniques for obtaining and analyzing land use data are described. Topics discussed include: geographic applications program and test sites; acquisition of high altitude photography and ERTS-1 imagery for land use mapping; supplemental source material; plotting bases; land use classifications using remote sensor data; land use interpretation and map compilation field verification of land use mapping; geographic information systems. GRA

N76-14584# JRB Associates, La Jolla, Calif.
INFRARED SENSOR FOR THE REMOTE MONITORING OF SO2 Final Report
E. R. Bartle and E. A. Meckstroth May 1975 55 p refs
(Contract EPA-68-02-1208)
(PB-243478/5; EPA-650/2-75-041) Avail: NTIS HC $4.50 CSCL 17E

A prototype passive infrared sensor for the measurement of sulfur dioxide emissions from stationary sources is described. The infrared radiation emitted by gases in a plume originating from smokestacks may be detected, and from this the SO2 concentration in the plume may be determined. In general, the radiation received by the sensor is a function of the intervening and background atmosphere. Thus, the problem of quantitative measurements is generally complex. A technique is described, based upon the principle of Gas Filter Correlation, which minimizes these effects. This report presents a detailed description of the sensor, its specifications, and performance characteristics. The results of field testing at both oil and coal-burning power plants are compared with extractive sample data. In general, the remote measurements agree with the extractive data within + or - 25 percent over SO2 concentrations ranging from 150ppm to 1300ppm from slant ranges of 130 to 400 m. GRA

N76-14647*# Stanford Research Inst., Menlo Park, Calif.
A PRELIMINARY STUDY OF AIR-POLLUTION MEASUREMENT BY ACTIVE REMOTE-SENSING TECHNIQUES Final Report
M. L. Wright, E. K. Proctor, L. S. Gasiorek, and E. M. Liston Jun. 1975 341 p refs
(Contract NAS1-11657; SRI Proj. 1966)
(NASA-CR-132724) Avail: NTIS HC $10.00 CSCL 13B

Air pollutants are identified, and the needs for their measurement from satellites and aircraft are discussed. An assessment is made of the properties of these pollutants and of the normal atmosphere, including interactions with light of various wavelengths and the resulting effects on transmission and scattering of optical signals. The possible methods for active remote measurement are described; the relative performance capabilities of double-ended and single-ended systems are compared qualitatively; and the capabilities of the several single-ended or backscattering techniques are compared quantitatively. The differential-absorption lidar (DIAL) technique is shown to be superior to the other backscattering techniques. The lidar system parameters and their relationships to the environmental factors and the properties of pollutants are examined in detail. A computer program that models both the atmosphere (including pollutants) and the lidar system is described. The performance capabilities of present and future lidar components are assessed, and projections are made of prospective measurement capabilities for future lidar systems. Following a discussion of some important operational factors that affect both the design and measurement capabilities of airborne and satellite-based lidar systems, the extensive analytical results obtained through more than 1000 individual cases analyzed with the aid of the computer program are summarized and discussed. The conclusions are presented. Recommendations are also made for additional studies to investigate cases that could not be explored adequately during this study. Author

N76-14712# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A PRELIMINARY STUDY OF REMOTE SENSOR APPLICATIONS TO LOCAL WEATHER SERVICES
Roger S. Rhodes Apr. 1975 39 p refs
(COM-75-11046/0; NOAA-TR-ERL-330; WPL-40; NOAA-7571102) Avail: NTIS HC $4.00; HC also available from SOD as C55.13:ERL-330-WPL-40 CSCL 04B

A study was initiated by NOAA's Wave Propagation Laboratory to gain greater insight into the most effective ways for new sensor technology programs to benefit the local weather services. The objectives were to clarify the general nature of local weather services, to establish the relative importance and utility of each service output, and to develop a frame of reference for planning future sensor research activity. While it does not provide the final answer to these objectives, this report presents a preliminary analysis of these important areas. The conclusion is reached that the first productive user of new sensor technology is most likely to be atmospheric research programs, with operational use evolving later. Improved communications between the sensor development agencies and the various user groups is recommended. GRA

N76-15524 Denver Univ., Colo.
GEOGRAPHIC RESEARCH FROM EARTH ORBIT, WITH SPECIAL EMPHASIS ON LAND-USE Ph.D. Thesis
Charles Theodore Naftel Paludan 1975 166 p
Avail: Univ. Microfilms Order No. 76-1241

It is proposed that the availability of repetitive observations from satellites yields information of significant benefit to the study of geography. A specific example of a land use survey of a selected test site was used to test the theory. Data from the LANDSAT 1 satellite, from aircraft at very high and medium altitudes, and from ground surveying were used. Objectives of the study were: (1) to develop new approaches and ways of measuring interrelationships, (2) to attempt to study all significant phenomena in a area, (3) to include temporal data, (4) to study human/nature relationships, and (5) to determine areal distributions and pattern associations. The test site was located in Madison County, Alabama. During analysis of the data, several maps were produced. Using these maps as information products, tests were applied to show that the experimental objectives were met. Dissert. Abstr.

N76-15525*# Kentucky Univ. Research Foundation, Lexington. Dept. of Forestry.
REMOTE SENSING OF EFFECTS OF LAND-USE PRACTICES ON WATER QUALITY
Donald H. Graves [1975] 18 p
(Contract NAS8-31006)
(NASA-CR-144105) Avail: NTIS HC $3.50 CSCL 08H

Research efforts are presented for the use of remote sensing in environmental surveys in Kentucky. Ground truth parameters were established that represent the vegetative cover of disturbed and undisturbed watersheds in the Cumberland Plateau of eastern Kentucky. Several water quality parameters were monitored of the watersheds utilized in the establishment of ground truth data. The capabilities of multistage-multispectral aerial photography and satellite imagery were evaluated in detecting various land use practices. The use of photographic signatures of known land use areas utilizing manually-operated spot densitometers was studied. The correlation of imagery signature data to water quality data was examined. Potential water quality predictions were developed from forested and nonforested watersheds based upon the above correlations. The cost effectiveness of predicting water quality values was evaluated using multistage and satellite imagery sampling techniques. Author

N76-15562# Environmental Research Inst. of Michigan, Ann Arbor.
AN EXPERIMENT IN THE APPLICATION OF REMOTE SENSING TO LAND-USE PLANNING ON THE URBAN FRINGE Final Report, May 1971 - Jun. 1974
E. Perlman and R. K. Raney Jun. 1975 44 p refs
(Grant NSF GI-34809)
(PB-244517/9; ERIM-193500-6-F3; NSF/RA/E-75-038) Avail: NTIS HC $4.00 CSCL 13B

Major results and conclusions are presented for the effort to foster and test the use of a remote-sensing information system in the local land-use planning process. Remote-sensing flights over Vienna Township, Michigan were designed to provide imagery and quantitative data on land use and land-cover features in a developing rural-suburban area on the urban fringe. The particular township was chosen as a prototype of those areas bordering metropolitan centers, largely rural but increasingly suburban, which are confronted with the need to monitor and regulate the transition to expanded suburban and urban uses. GRA

N76-15568# Mitre Corp., McLean, Va.
RESOURCE AND LAND INVESTIGATIONS (RALI) PROGRAM: AN APPROACH TO ENVIRONMENTAL ASSESSMENT WITH APPLICATION TO WESTERN COAL DEVELOPMENT Final Report
A. Bisselle, A. Binder, R. Holberger, L. Morrow, and R. Pagano Aug. 1975 617 p refs
(Contract DI-14-08-0001-15105)
(PB-244632/6; MTR-6988; USGS-LI-75/006) Avail: NTIS

HC $16.25 CSCL 08I

Use of the coal reserves in the western part of the U.S. is considered a possible means of achieving a measure of energy self-sufficiency. In addition to strip mining, the development of western coal can include mine-mouth electricity generation or coal gasification as well as the shipment of energy via unit trains, slurry pipelines, or overhead transmission lines. An approach is described for evaluating the environmental impacts of the various coal-development projects. Each project is composed of a number of activities and the primary as well as high-order impacts of these activities are linked by means of key-word cross referencing. GRA

N76-15569# Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.

THE RESERVE BASE OF COAL FOR UNDERGROUND MINING IN THE WESTERN UNITED STATES Information Circular, 1975

Thomas K. Matson and Doss H. White, Jr. Jul. 1975 242 p refs

(PB-244909/8; BM-IC-8678) Avail: NTIS HC $7.75 CSCL 08I

The coal reserve base in the Western United States is presented for coalbeds amenable to extraction by underground mining methods. The Federal Bureau of Mines has abstracted data on the quality and quantity of coal resources/reserves from numerous state and federal publications and modified such data as necessary to allow computer storage and retrieval. Tonnages are compiled by state, county, coalbed, and rank, and allotted to sulfur categories by statistical apportionment. GRA

N76-15669# Naval Postgraduate School, Monterey, Calif.

DEVELOPMENT OF AN OIL-WATER POLLUTION MONITORING SYSTEM Annual Progress Report, 1975

T. M. Houlihan and B. D. Tyler 30 Jul. 1975 90 p refs

(AD-A014552; NPS-59Hm75071A) Avail: NTIS CSCL 13/2

This report documents the progress during FY75 in the fabrication and the testing of an automatic oil pollution monitoring system. In the system developed, a Direct Difference method of Total Organic Carbon determination was utilized to ascertain oil concentrations. Using this monitor, it was possible to specify the concentration of any oil, independent of type, in an oil separator effluent sample. In the final phases of the study, preliminary investigations on prototype improvements were initiated and oil concentrations of bilge water samples were determined.

Author (GRA)

N76-15675# Syracuse Univ. Research Corp., N.Y. Life Sciences Div.

BENZENE, ENVIRONMENTAL SOURCES OF CONTAMINATION, AMBIENT LEVELS, AND FATE Final Report

P. H. Howard and P. R. Durkin Dec. 1974 73 p refs

(Contract EPA-68-01-2679)

(PB-244139/2; SURC-TR-74-591; EPA-560/5-75-005) Avail: NTIS HC $4.50 CSCL 13B

Available information pertinent to an assessment of benzene contamination of the environment is reviewed. Benzene losses from commercial (production and use) and noncommercial (automotive emissions and oil spills) sources were considered. It is estimated that of the total quantity that is released to the environment more than half results from motor vehicle emissions. Monitoring data somewhat support this contention. Available information on the environmental persistence of benzene suggests that it degrades slowly. GRA

N76-15731# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

INFRARED LABORATORY SPECTROSCOPY IN SUPPORT OF STRATOSPHERIC MEASUREMENTS Final Report, 1 Oct. 1974 - 30 Jun. 1975

Robert A. Toth 1975 8 p

(Contract DOT-AS-20094)

(PB-244831/4) Avail: NTIS HC $3.50 CSCL 04A

The objective of this laboratory study is to determine the spectral characteristics (line center frequencies, line strengths and pressure-broadened linewidths) for several molecules that are present in the earth's stratosphere and are of particular interest to the Climatic Impact Assessment Program of the U.S. Department of Transportation. The molecules investigated are: CH4, N2O, H2CO, NO2, and H2O. GRA

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A76-12004 Publication of scientific results of the INTERCOSMOS collaboration (Publikatsiia nauchnykh rezul'tatov sotrudnichestva 'INTERKOSMOS'). Edited by L. V. Rykhlova. Moscow, Astronomicheskii Sovet Akademii Nauk SSSR (Nabliudeniia Iskusstvennykh Sputnikov Zemli, No. 13), 1974. 243 p. In Russian and German.

The papers deal with investigations of the earth's gravitational potential, methods of improving the determination accuracy of satellite orbits, dynamic methods of satellite geodesy, and the use of satellite observations in geodynamics. Attention is given to the gravitational disturbances of satellite motion and to the influence of nongravitational forces on satellite motion.

V.P.

A76-12019 # The use of satellite observations for the solution of problems in geodynamics (Ispol'zovanie nabliudenii ISZ dlia resheniia zadach geodinamiki). L. V. Rykhlova. In: Publication of scientific results of the INTERCOSMOS collaboration. Moscow, Astronomicheskii Sovet Akademii Nauk SSSR, 1974, p. 194-218. 35 refs. In Russian.

Geodynamics has been variously defined as the dynamics of the earth-moon system and of satellites as indicators of the forces acting in the system, and as a study which takes in polar motion and earth rotation, variations of earth surface movements and variations of geopotential, and earth tidal motion. The survey paper limits itself to the problems of polar motions and tidal motions, based on satellite tracking data. The secular motion of the poles and variations in the geopotential are touched upon. B.J.

A76-12043 # Geodetic research in Finland with balloons and satellites. J. Kakkuri (Geodeettinen Laitos, Helsinki, Finland). In: Scientific results of the INTERCOSMOS collaboration; Conference on Scientific Research by Artificial Satellites Observations, Budapest, Hungary, October 21-24, 1974, Transactions. Bucharest, Editura Academiei Republicii Socialiste Romania, 1975, p. 215-219.

Light flashes triggered electronically from freely ascending balloons were photographed using Schmidt-Vaisala telescopes to measure the 14-point stellar triangulation net of Finland. The accuracy of the stellar triangulation was shown to be 1:500,000, in accordance with the first-order terrestrial triangulation. A 890 km base line to serve as a scale for the stellar triangulation net has been measured from North to South Finland using a laser geodimeter. Photographic observations of the satellites Pageos-1 and Geos-2 are briefly discussed. Technical parameters of a satellite lidar to be used jointly by Finland and Sweden to establish geodetic ties between Finland and other European countries and to investigate crust movements are given. The wavelength of the ruby laser is 694.3 nm; pulse energy is 1 J; pulse length is 25 nm. Technical properties of the Cassegrain telescope recently (1973-1974) built in Metsahovi are presented. C.K.D.

A76-12189 # Autonomous determination of the location of an object moving along the earth's surface with allowance for its nonsphericity (Pro avtonomne viznachennia mistsepolozhennia ob'ekta na poverkhni zemli z vrakhuvanniam ii nesferichnosti). M. E. Temchenko (Akademiia Nauk Ukrains'koi RSR, Institut Matematiki, Kiev, Ukrainian SSR). *Akademiia Nauk Ukrains'koi RSR, Dopovidi, Seriia A - Fiziko-Matematichni ta Tekhnichni Nauki,* Sept. 1975, p. 806-810. 5 refs. In Ukrainian.

A problem is considered of determining location of an object moving arbitrarily on the surface of the earth taken as a homogeneous three-axis ellipsoid. Using the Rodrigues-Hamilton and Klein parameters as well as a Cartesian plane coordinate system stereographically mapped into the sphere, the object coordinates and its orientation are determined in space both in the middle and high latitudes without using a quasi-geographic system of coordinates. (Author)

A76-12225 A comparison of methods for computing surface densities of the geopotential from satellite altimetry. W. Benning (Bonn, Universität, Bonn, West Germany). *Zeitschrift für Geophysik,* vol. 41, no. 5, 1975, p. 501-511. 8 refs.

A solution for the earth's gravitational field represented by the potential of a simple layer is obtained by analyzing 11,700 altimeter and 500 distance measurements. The unknown density values of the simple-layer model are fitted to the data, and the global gravitational field is separated into several regional representations. To evaluate the data for a fine-structured and global-geoid resolution, two methods are used; their differences and advantages are examined. First, an iterative method employing a global adjustment is applied to determine coarse-structured density values. Based on this approximate solution, analysis of all data may be repeated step by step for all regional representations of fine-structured density values. Second, a detailed resolution for a regional part of the geoid is solved directly. In this way, the global solution may be kept step by step by adjusting the regional ones. (Author)

A76-12317 # Experience in providing a geodesic base for stationary observations of the erosion of soils and the effectiveness of counter-erosion measures (Opyt postroeniia geodezicheskoi osnovy dlia statsionarnykh nabliudenii za eroziei pochv i effektivnost'iu protivoerozionnykh meropriiatii). G. E. Somov, I. V. Zhuravel', A. A. Reminskii, and V. N. Opara. *Geodeziia, Kartografiia i Aerofotos'emka,* no. 21, 1975, p. 54-60. 7 refs. In Russian.

A76-13292 Satellite geodesy (Satellitengeodäsie). M. Schneider (München, Technische Universität, Munich, West Germany). *Sterne und Weltraum,* vol. 14, Nov. 1975, p. 357-363. In German.

The methods of satellite geodesy made it possible to establish the geoid form of the earth within a time of about 15 years. Certain gaps between images of the earth obtained by terrestrial ground surveys and by the utilization of artificial earth satellites are to be closed with the aid of the U.S. satellite GEOS C. A description of satellite observational methods is presented and attention is given to new developments related to the design of the French satellite STARLETTE and the American satellite LAGEOS. G.R.

A76-16514 * A comparison of electric and magnetic field data from the OGO 6 spacecraft. R. A. Langel (NASA, Goddard Space Flight Center, Geophysics Branch, Greenbelt, Md.). *Journal of Geophysical Research,* vol. 80, Dec. 1, 1975, p. 4661-4673. 24 refs.

Previous studies of OGO 6 electric-field data and magnetic-field magnitude observations have indicated a distinct dependence of disturbance characteristics on interplanetary-sector polarity. Examination of simultaneous data below 600 km over the summer polar cap shows that changes in electric-field patterns and the disturbance patterns in magnetic-field magnitude are highly correlated. This correlation extends to pattern shapes, boundary locations, and the amplitudes of the correlated quantities. In the winter hemisphere at altitudes above 800 km, correlations between boundaries exist, pattern correlations are present but not as strong as at low altitudes in summer, and amplitude correlations are essentially absent. These studies verify that below 600 km, the region of positive magnetic-field magnitude, from 2200 to 1000 magnetic local time (MLT), receives a significant contribution from both ionospheric and nonionospheric sources. Above 800 km, the nonionospheric sources dominate. These data are also consistent with the existence of a

latitudinally broad current system at sunlit magnetic local times as the source of the negative-magnitude region between 1000 and 2200 MLT. In this region, broad structures in electric-field patterns and in magnetic-field magnitude patterns are highly correlated. Multiple peaks in the negative-magnitude, presumably identified with the multiple peaks in negative electric-field magnitude found by Langel (1973) in average surface data, occur when the electric-field pattern has multiple reversals near dusk. (Author)

A76-17234 **On reference coordinate systems for earth dynamics; Proceedings of the Colloquium, Uniwersytet Torunski, Torun, Poland, August 26-31, 1974, Proceedings.** Colloqium sponsored by IAU, COSPAR, International Geodetic Association, and Smithsonian Institution. Edited by B. Kolaczek (Warszawa, Politechnika, Warsaw, Poland) and G. Weiffenbach (Smithsonian Astrophysical Observatory and Harvard College Observatory, Cambridge, Mass.). Warsaw, Politechnika Warszawska (IAU Colloquium, No. 26), 1975. 478 p.

Papers are presented dealing with the problem of defining and realizing reference coordinate systems for earth dynamics and of determining the relations between different reference systems. Some of the topics covered include the nature of requirements for reference coordinate systems, gravimetric and astrogeodetic reference systems in space and time, definition of the celestial reference coordinate system in fundamental catalogues, geodetic and astrometric results of very long baseline interferometric measurements of natural radio sources, classical methods for the determination of universal time and polar motion, and coordinate systems in lunar ranging.

P.T.H.

A76-17245 # **Practical realization of a reference system for earth dynamics by satellite methods.** R. J. Anderle and M. C. Tanenbaum (U.S. Naval Material Command, Warfare Analysis Dept., Dahlgren, Va.). In: On reference coordinate systems for earth dynamics; Proceedings of the Colloquium, Torun, Poland, August 26-31, 1974. Warsaw, Politechnika Warszawska, 1975, p. 341-380. 29 refs.

Observations of artificial earth satellites provide a means of establishing an origin, orientation, scale and control points for a coordinate system. Existing satellite data have provided about .01 accuracy on the pole position and to possibly a meter on the origin of the system and for control points. The longitude origin is essentially arbitrary. While these accuracies permit acquisition of useful data on tides and polar motion through dynamic analyses, they are inadequate for determination of crustal motion or significant improvement in polar motion. The limitations arise from gravity, drag and radiation forces on the satellites as well as from instrument errors. Improvements in laser equipment and the launch of the dense LAGEOS satellite in an orbit high enough to suppress significant gravity and drag errors will permit determination of crustal motion and more accurate, higher frequency, polar motion. (Author)

N76-11490* National Oceanic and Atmospheric Administration, Rockville, Md.
SCIENTIFIC VALUE OF SEASAT FOR GEODESY
Bernard H. Chovitz *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 50-53 refs
CSCL 08E

SEASAT altimetry data which relate directly to geoid heights provide the means to obtain information on the geoid on a global scale which is not attenuated by height or by high frequency averaging. The most important geodetic application of these data is to provide a standard reference surface for oceans. Author

N76-12428*# Hunting Surveys, Ltd., Boreham Wood (England).
CARTOGRAPHIC RESEARCH IN EREP PROGRAM FOR SMALL SCALE MAPPING Final Report
P. G. Mott, H. Fullard, J. C. Bartholomew, J. D. Leatherdale, H. J. Chismon, and H. M. Hall, Principal Investigators Jun. 1975 36 p Sponsored by NASA EREP
(E76-10039; NASA-CR-144478) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Skylab photography is suitable for producing planimetric maps with graphical representation of landform at scales up to 1:100,000. It cannot supply all the detail necessary for maps at this scale, but it may be used to produce a sound framework which can be completed by detail from other sources. Its principal cartographic use is for original mapping of undeveloped areas of the world, but it would also be useful for the revision of existing maps and for monitoring extensive urban changes.

N76-13580# Geological Survey, Reston, Va.
RESEARCH AND DEVELOPMENT IN TOPOGRAPHIC MAPPING
24 Jul. 1975 85 p refs
(PB-243596/4; USGS/TD-75/001) Avail: NTIS HC $5.00 CSCL 08B

The annual report, covering the 12-month period ending in April 1975, summarizes the research and development activities of the U.S. Geological Survey, Topographic Division in the Office of Research and Technical Standards and in the Mapping Center offices at Reston, Va., Rolla, Mo., Denver, Colo., and Menlo Park, Calif. The R and D projects mentioned concern the fields of cartography, field surveys, photogrammetry, orthophotomapping, and space technology. Articles by Division personnel prepared for presentation at meetings and conferences or for publication in professional journals and the Manual of Topographic Instructions are also listed. GRA

04
GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A76-11939 **Analysis of the residual geomagnetic field according to the Cosmos-49 model.** N. V. Adam, N. P. Ben'kova, and T. N. Cherevko. *(Kosmicheskie Issledovaniia,* vol. 13, Mar.-Apr. 1975, p. 236-241.) *Cosmic Research,* vol. 13, no. 2, Sept. 1975, p. 208-212. 6 refs. Translation.

Ben'kova (1973) has calculated the distribution of the remanent magnetic field as the difference between the measurements onboard the Cosmos 49 satellite and the values obtained with a Cosmos-49 model, using nine terms of a series in spherical harmonic functions. The possibility of improving modular models by increasing the number of terms of the series is studied by analyzing the distribution of the remanent magnetic field. V.P.

A76-15454 * **Exploration for fossil and nuclear fuels from orbital altitudes.** N. M. Short (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 189-232.

A review of satellite-based photographic (optical and infrared) and microwave exploration and large-area mapping of the earth's surface in the ERTS program. Synoptic cloud-free coverage of large areas has been achieved with planimetric vertical views of the earth's surface useful in compiling close-to-orthographic mosaics. Radar penetration of cloud cover and infrared penetration of forest cover have been successful to some extent. Geological applications include map editing (with corrections in scale and computer processing of images), landforms analysis, structural geology studies, lithological identification, and exploration for minerals and fuels. Limitations of the method are noted. R.D.V.

A76-15458 * **Space acquired imagery, a versatile tool in the development of energy sources.** D. L. Amsbury (NASA, Johnson Space Center, Houston, Tex.). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 395-402. 8 refs.

The two-dimensional images acquired by satellite-borne instruments are continuous, they supplement surface data, subsurface data, and other geophysical data, and they can cut the amount of field work required for a given task by a whole order of magnitude. Images acquired with instruments mounted on the Apollo and Skylab orbiting spacecraft, and on the RB-57 and U-2 aircraft, are displayed and discussed. R.D.V.

A76-16291 **Thermal-infrared spectra and chemical analyses of twenty-six igneous rock samples.** R. K. Vincent (Geospectra Corp., Ann Arbor, Mich.), L. C. Rowan (U.S. Geological Survey, Washington, D.C.), R. E. Gillespie (EOCOM, Irving, Calif.), and C. Knapp (Colorado, University, Boulder, Colo.). *Remote Sensing of Environment,* vol. 4, no. 3, 1975, p. 199-209. 12 refs. U.S. Bureau of Mines Contract No. H0210041.

Emittance spectra in the 7.5 micron to 14 micron wavelength region and chemical compositions of 26 igneous rocks are reported. Experimental measurements on the rocks were made under simulated daytime field conditions. Some surface silicate contaminants, such as clayey silt, significantly altered the spectral emittance of a fresh sample, whereas, for these samples, hydrous and anhydrous ferric oxide weathering products did not mask important silicate spectral information. In the 11.75 mciron to 13.75 micron wavelength region, the mean emittance of all the silicate samples was about 0.956, except for periodtite, which had an average emittance of 0.895. This region of uniform emittance should be useful in remote sensing experiments for the separation of the effects of temperature and chemical composition on the spectral emittance of silicate rocks. (Author)

N76-10548*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
APPLICATION OF ERTS IMAGERY TO THE STUDY OF RESIDUAL KAOLINS Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and R. W. Pollok Dec. 1974 3 p ERTS
(Contract NAS5-23133)
(E76-10016; NASA-CR-119124; ORSER-SSEL-TR-26-74) Avail: NTIS HC $3.25 CSCL 08G

N76-10611*# Arizona Univ., Tucson. Office of Arid Lands Studies.
TECTONIC ANALYSIS OF FOLDS IN THE COLORADO PLATEAU OF ARIZONA
George H. Davis Aug. 1975 75 p refs Prepared in cooperation with Ariz. Oil and Gas Conserv. Comm. and Ariz. Resources Inform. System
(Grant NGL-03-002-313)
(NASA-CR-145433; OALS-Bull-9) Avail: NTIS HC $4.25 CSCL 08G

Structural mapping and analysis of folds in Phanerozoic rocks in northern Arizona, using LANDSAT-1 imagery, yielded information for a tectonic model useful in identifying regional fracture zones within the Colorado Plateau tectonic province. Since the monoclines within the province developed as a response to differential movements of basement blocks along high-angle faults, the monoclinal fold pattern records the position and trend of many elements of the regional fracture system. The Plateau is divided into a mosaic of complex, polyhedral crustal blocks whose steeply dipping faces correspond to major fracture zones. Zones of convergence and changes in the trend of the monoclinal traces reveal the corners of the blocks. Igneous (and salt) diapirs have been emplaced into many of the designated zones of crustal weakness. As loci of major fracturing, folding, and probably facies changes, the fractures exert control on the entrapment of oil and gas. Author

N76-11510 Joint Publications Research Service, Arlington, Va.
APPLICATION OF SPACE SURVEY MATERIALS IN SOLVING THEORETICAL AND PRACTICAL PROBLEMS IN GEOLOGY
V. N. Bryukhanov, V. K. Yeremin, V. I. Makarov, G. V. Makhin, B. N. Mozhayev, V. G. Trifonov, and P. V. Florenskiy *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 3-15 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 13 p

Photographic surveys (visible and near infrared) were successfully tested covering the wavelength range from 0.4 to 0.9 microns for geologic information. Space surveys were obtained by both photographic and television-scanner methods. Small scale, increased coverage, natural generalization, and increased interpretation effectiveness were characterized. Automation of geologic interpretation is proposed. J.A.M.

N76-11517* National Aeronautics and Space Administration, Washington, D.C.
SPACE SATELLITE TO AID ARCTIC OIL DEVELOPMENT
28 Oct. 1975 7 p
(NASA-News-Release-75-282) Avail: NASA Scientific and

Technical Information Facility P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 08G

A project which utilizes the Nimbus-6 weather satellite and air-dropable data collection platforms for observation of Arctic ice movement is described. The information gained from the project could be valuable for planning oil recovery operations in the area. D.M.L.

N76-11518*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Oct. 1975
Paul M. Merifield, Principal Investigator 8 Oct. 1975 2 p EREP
(Contract NAS2-7698)
(E76-10020; NASA-CR-145390; MPR-28) Avail: NTIS HC $3.50 CSCL 08G

N76-11527*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO USING ERTS-1 DATA *Final Report, 30 Jun. 1972 - 1 Aug. 1974*
Daniel H. Knepper, Principal Investigator Aug. 1974 224 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dokato Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21778)
(E76-10029; NASA-CR-145421; Rept-75-1) Avail: NTIS HC $7.75 CSCL 08G

The author has identified the following significant results. Most of the geologic information in ERTS-1 imagery can be extracted from bulk processed black and white transparencies by a skilled interpreter using standard photogeologic techniques. In central and western Colorado, the detectability of lithologic contacts on ERTS-1 imagery is closely related to the time of year the imagery was acquired. Geologic structures are the most readily extractable type of geologic information contained in ERTS images. Major tectonic features and associated minor structures can be rapidly mapped, allowing the geologic setting of a large region to be quickly accessed. Trends of geologic structures in younger sedimentary appear to strongly parallel linear trends in older metamorphic and igneous basement terrain. Linears and color anomalies mapped from ERTS imagery are closely related to loci of known mineralization in the Colorado mineral belt.

N76-11532*# Rockwell International Science Center, Thousand Oaks, Calif.
ANALYSIS OF TECTONIC FEATURES IN US SOUTHWEST FROM SKYLAB PHOTOGRAPHS Final Report, 14 May 1973 - 30 Jun. 1975
Monem Abdel-Gawad, Principal Investigator and Linda Tubbesing 15 Sep. 1975 95 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contracts NAS2-7523; NAS9-14440)
(E76-10034; NASA-CR-144464; SC5007.16FR) Avail: NTIS HC $5.00 CSCL 08B

The author has identified the following significant results. Skylab photographs were utilized to study faults and tectonic lines in selected areas of the U.S. Southwest. Emphasis was on elements of the Texas Zone in the Mojave Desert and the tectonic intersection in southern Nevada. Transverse faults believed to represent the continuation of the Texas Zone were found to be anomalous in strike. This suggests that the Mojave Desert block was rotated counterclockwise as a unit with the Sierra Nevada. Left-lateral strike-slip faults in Lake Mead area are interpreted as elements of the Wasatch tectonic zone; their anomalous trend indicates that the Lake Mead area has rotated clockwise with the Colorado Plateau. A tectonic model relating major fault zones to fragmentation and rotation of crustal blocks was developed. Detailed correlation of the high resolution S190B metric camera photographs with U-2 photographs and geologic maps demonstrates the feasibility of utilizing S190B photographs for the identification of geomorphic features associated with recent and active faults and for the assessment of seismic hazards.

N76-11533*# Kennecott Exploration, Inc., Salt Lake City, Utah.
RESEARCH ON RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY COPPER DEPOSITS ON ERTS-1 IMAGERY Final Report
John C. Wilson, Principal Investigator Sep. 1975 225 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21769)
(E76-10035; NASA-CR-145425) Avail: NTIS HC $7.75 CSCL 08G

The author has identified the following significant results. Many new linear and circular features were found. These features prompted novel tectonic classification and analysis especially in the Ray and Ely areas. Tectonic analyses of the Ok Tedi, Tanacross, and Silvertone areas follow conventional interpretations. Circular features are mapped in many cases and are interpreted as exposed or covered intrusive centers. The small circular features reported in the Ok Tedi test area are valid and useful correlations with tertiary intrusion and volcanism in this remote part of New Guinea. Several major faults of regional dimensions, such as the Denali fault in Alaska and the Colorado mineral belt structures in Colorado are detected in the imagery. Many more faults and regional structures are found in the imagery than exist on present maps.

N76-12437*# Geological Survey, Menlo Park, Calif.
IDENTIFICATION OF GEOSTRUCTURES OF THE CONTINENTAL CRUST PARTICULARLY AS THEY RELATE TO MINERAL RESOURCE EVALUATION Final Report, 1 Jul. 1972 - 6 Jul. 1974
Ernest H. Lathram, Principal Investigator 1 Sep. 1974 59 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E76-10048; NASA-CR-145588) Avail: NTIS HC $4.50 CSCL 08G

The author has identified the following significant results. A pattern of very old geostructures was recognized, reflecting structures in the crust. This pattern is not peculiar to Alaska, but can be recognized throughout the northern cordillera. A new metallogenic hypothesis for Alaska was developed, based on the relationship of space image linears to known mineral deposits. Using image linear analysis, regional geologic features were also recognized; these features may be used to guide in the location of undiscovered oil and/or gas accumulations in northern Alaska. The effectiveness of ERTS data in enhancing medium and small scale mapping was demonstrated. ERTS data were also used to recognize and monitor the state of large scale vehicular scars on Arctic tundra.

N76-12439*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN *Progress Report, 1 Dec. 1973 - 31 Jan. 1974*
G. J. McMurtry and G. W. Petersen, Principal Investigators 31 Jan. 1974 8 p refs ERTS
(Contract NAS5-23133)
(E76-10050; NASA-CR-145590) Avail: NTIS HC $3.50 CSCL 08H

N76-12440*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN Progress Report, 1 Feb. - 31 Mar. 1974
G. J. McMurtry and G. W. Petersen, Principal Investigators

31 Mar. 1974 13 p refs ERTS
(Contract NAS5-23133)
(E76-10051; NASA-CR-145591) Avail: NTIS HC $3.50 CSCL 08H

N76-13577# Northern Great Plains Resource Program, Denver, Colo.
SURFACE RESOURCES WORK GROUP, IMPACT ANALYSIS
Mar. 1974 336 p Sponsored in part by Dept. of Agriculture, Dept. of Interior, and EPA
(PB-243153/4; NGPRP/CD-74/401) Avail: NTIS HC $10.00 CSCL 13B

The impact on surface resources is described that could result from three alternative levels of potential coal development on the Northern Great Plains. A 63 county area of the states of North Dakota, Montana, Wyoming, and South Dakota is surveyed. It addresses 11 areas of potential impacts covered include: (1) land resources; (2) soils; (3) vegetation; (4) fish and wildlife resources; (5) recreation resources; (6) agricultural resources; (7) wilderness-wild lands resources; (8) scenery resources; (9) forest-products; (10) surface rehabilitation potentials and limitations; and (11) ecosystems relationships. Data are presented on the significance of potential impacts that could result from different levels of coal mining and conversion. GRA

N76-14573* Minnesota Geological Survey, St. Paul.
APPLICATIONS OF LANDSAT IMAGERY TO GEOLOGICAL RESEARCH IN MINNESOTA
P. W. Weiblen, G. B. Morey, and M. S. Walton *In* Minn. Univ. A study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 11 p refs

CSCL 08G

A large part of northeastern Minnesota north of Lake Superior was studied using Landsat images. The area is being studied for its intercontinental rift and for large, low grade, copper-nickel deposits. By using Landsat imagery in conjunction with field data, it is possible to develop a much higher level of continuity and structural resolution in interpretations of the bedrock geology. Preliminary results indicate that it is possible to distinguish various surficial morphological features such as the Vermilion and Highland moraines, the Toimi drumlin field, and an unnamed drumlin field apparently associated with the Highland moraine. J.A.M.

N76-14581# Chem Systems, Inc., New York.
CHEMICALS FROM COALS AND SHALE AN R AND D ANALYSIS FOR NATIONAL SCIENCE FOUNDATION Final Report, May 1974 - Jul 1975
Martin B. Sherwin and Marshall E. Frank Jul. 1975 442 p refs
(Grant NSF EN-43237)
(PB-243393/6) Avail: NTIS HC $11.75 CSCL 07A

An analysis was made of the economic and technical factors involved in the manufacture of primary organic chemicals such as olefins, aromatics, acetylene, ammonia, and methanol from coal and shale. The technologies discussed are compared to present conventional technology which is based upon oil and natural gas. Chemical market demands and feedstock demands to the year 2000 are projected to estimate when coal and shale based processes would be required. The above inputs are utilized in outlining a research program which would insure the availability of this new technology. GRA

N76-15537*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
SKYLAB-4 VISUAL OBSERVATIONS PROJECT: GEOLOGICAL FEATURES OF SOUTHWESTERN NORTH AMERICA Final Report
Leon T. Silver 1 Nov. 1975 189 p
(Contract NAS9-13960)
(NASA-CR-147392) Avail: NTIS HC $7.50 CSCL 08G

Visual observations conducted by Skylab-4 crewmen on seven designated geological target areas and other targets of opportunity in parts of southwestern United States and northwestern Mexico were described. The experiments were designed to learn how effectively geologic features could be observed from orbit and what research information could be obtained from the observations when supported by ground studies. For the limited preparation they received, the crewmen demonstrated exceptional observational ability and produced outstanding photographic studies. They also formulated cogent opinions on how to improve future observational and photo-documentation techniques. From the photographs and other observations, it was possible to obtain significant research contributions to on-going field investigations. These contributions were integrated into other aspects of the ground investigations to the following topics: major faults, regional stratigraphy, occurrence of Precambrian crystalline rocks, mapping of Mesozoic volcanic rocks, regional geology. Author

05

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A76-10070 # **Temporal and spatial behavior of large-scale disturbances in tropical cloudiness deduced from satellite brightness data.** A. Zangvil (California, University, Los Angeles, Calif.). *Monthly Weather Review,* vol. 103, Oct. 1975, p. 904-920. 38 refs. NSF Grants No. GA-41014X; No. OCD-74-00162.

A76-10072 # **A preliminary analysis of factors affecting the frequency of August southeastern North Pacific tropical storms and hurricanes since the advent of satellite observations.** R. R. Dickson (NOAA, National Meteorological Center, Washington, D.C.). *Monthly Weather Review,* vol. 103, Oct. 1975, p. 926-928. 7 refs.

A76-10107 # **Measurement of sea surface temperature by the NOAA-2 satellite.** J. L. Cogan and J. H. Willand (Environmental Research and Technology, Inc., Concord, Mass.). In: Symposium on Meteorological Observations and Instrumentation, 3rd, Washington, D.C., February 10-13, 1975, Preprints. Boston, Mass., American Meteorological Society, 1975, p. 123-130. 18 refs.

Manual and computerized techniques are proposed for an accurate mapping of sea surface temperature to an accuracy of about + or - 1 K on a day-to-day basis from satellite measurements of infrared radiances up to about 500 km from the subsatellite track, provided data on atmospheric variables, especially water vapor, are available. The above accuracy is obtained by means of a correction for the temperature difference resulting from atmospheric attenuation which is computed in terms of atmospheric parameters. Three separate programs for processing the taped data are discussed. Results of the manual and automated mapping techniques are presented. S.D.

A76-10108 # **The application of the Nimbus 5 ESMR to sea surface wind determination.** R. R. Sabatini (Earth Satellite Corp., Washington, D.C.). In: Symposium on Meteorological Observations and Instrumentation, 3rd, Washington, D.C., February 10-13, 1975, Preprints. Boston, Mass., American Meteorological Society, 1975, p. 131-136. 17 refs. Contract No. N66314-73-C-1572.

A statistical relationship between wind and sea brightness temperature obtained in the Mediterranean is translated into a relationship between wind and effective surface emissivity. An emissivity versus wind equation is introduced into the equation expressing sea brightness temperature as derived from calculations through model atmospheres. The resulting equation expresses wind as a function of brightness temperature and atmospheric water. An error analysis is carried out to reveal the contribution of each atmospheric and surface parameter to the error in the wind estimate. Application of the brightness temperature versus wind equation to five ESMR sea brightness temperature maps of mistral occurrences discloses detailed wind features associated with mistrals. The weakest link in the chain connecting the brightness temperature measured by a satellite and surface winds over the sea is shown to be the description of the sea surface emissivity as a function of wind and other parameters affecting emissivity. S.D.

A76-11681 # **Measurement of the infrared radiation temperature of the water surface along the coastline of the Italian Adriatic by means of VHRR satellite data (Messung der Infrarotstrahlungstemperatur der Wasseroberfläche im Kustenverlauf der italienischen Adria mittels VHRR-Satellitendaten).** H. Kaminski (Bochum, Sternwarte, Bochum, West Germany). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 121, 123-137. 31 refs. In German.

Very high resolution radiometer data obtained by the NOAA 2, 3, and 4 satellites have been evaluated, revealing the existence of a zone with a distinct temperature gradient along the Italian Adriatic coast. This zone follows closely the 20-50 meter isobaths. Mixing with the free Adriatic water occurs to a limited extent only in summer months, so that the transport zone for ecological loads from industrial sites is very narrow. P.T.H.

A76-11807 # **Some results measuring ocean surface parameters from aerial photographs (Nekoturye rezul'taty izmereniia parametrov morskoi poverkhnosti po aerofotosnimkam).** E. K. Korchagin and R. N. Semenov (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka,* no. 6, 1974, p. 67-71. 7 refs. In Russian.

Results of measurements of the mean height of ocean waves from stereophotographs processed by the straight line method are examined. It is shown that in the case where one of the two profiling directions coincides with the direction of the crests of ripple waves in the presence of wind waves, the measurements exhibit anisotropy. The factors responsible for the anisotropy are identified. The mean wave heights determined from stereophotographs are compared with the mean heights of wind waves calculated on the basis of the wind factors responsible for wave formation. V.P.

A76-12472 # **Near and far field HF radar ground wave return from the sea.** I. Kay (Institute for Defense Analyses, Arlington, Va.). *Philips Research Reports,* vol. 30, 1975, p. 56-64. 5 refs.

A76-12648 # **The analysis of the near-surface energy transfer environment from thermal infrared imagery.** S. I. Outcalt (Michigan, University, Ann Arbor, Mich.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 267-275; Discussion, p. 275, 276. 21 refs. Army-supported research; Contract No. Nonr-426.

The radiant surface temperature imaged by thermal infrared line-scanning equipment is a product of both surface temperature and emissivity. In detail it is the integrated product of the evolutionary development of the near-surface energy transfer regime. The variation of surface radiant temperature spatially and temporally contains information about the structure, composition, and thermal state of near surface materials. It is suggested that the study of ground ice, sea/lake ice, and the thermal regimes of mountain snow and ice bodies, are reasonable targets for the quantitative application of thermal mapping technology, and that considerable technical development effort be expended on spectral, spatial, and temporal operators for use in computer processing of pictures for glaciological data. (Author)

A76-12650 * # **Geophysical studies of floating ice by remote sensing.** W. J. Campbell (U.S. Geological Survey, Tacoma, Wash.), W. F. Weeks (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.), R. O. Ramseier (Department of the Environment, Ottawa, Canada), and P. Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 305-327; Discussion, p. 327, 328. 54 refs. NASA-Navy-NSF-supported research.

This paper presents an overview of recent remote-sensing techniques as applied to geophysical studies of floating ice. The current increase in scientific interest in floating ice has occurred during a time of rapid evolution of both remote-sensing platforms and sensors. Mesoscale and macroscale studies of floating ice are discussed under three sensor categories: visual, passive microwave, and active microwave. The specific studies that are reviewed primarily investigate ice drift and deformation, and ice type and ice roughness identification and distribution. (Author)

A76-12654 # **Antarctic sea-ice variations from satellite sensing in relation to climate.** W. F. Budd (Department of Supply, Antarctic Div., Melbourne, Australia). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 417-426; Discussion, p. 427. 22 refs.

An analysis of records of annual mean temperatures around Antarctica shows large-scale anomalies of thousands of kilometers extent with typical variations of 2 deg from one year to another. From 1967 on, composite satellite photographs are available which show considerable variation in the sea-ice extent in different years up to about 5 deg of latitude. These largest differences seem to persist over entire seasons. In general there seems to be considerable association between the region around the Antarctic with the coldest temperatures and the regions of greatest sea-ice extent. An analysis of long-term records at a single location near the edge of the Antarctic sea ice indicates a strong correlation between variations in the annual mean temperature and the duration of the sea ice, such that a change of 1 deg in the annual mean temperature corresponds to about 70 d variation in the duration of the sea ice. A relation is obtained between variations of annual mean temperature and the mean extent of the sea ice, viz., a 1 deg change corresponds to approximately 2.5 deg latitude variation in the maximum sea-ice extent. The magnitude of the variations in the sea-ice extent observed from the satellite data in comparison with the large-scale temperature anomalies is compatible with the above relations, although some rotational shifts appear to take place. (Author)

A76-14445 **Airborne laser profiling of swell in an open ice field.** P. Wadhams (Cambridge University, Cambridge, England). *Journal of Geophysical Research,* vol. 80, Nov. 20, 1975, p. 4520-4528. 26 refs.

Airborne laser profiles of swell entering the drift ice off the east coast of Newfoundland were made using a Geodolite profiler mounted in a DC-4 ice patrol aircraft. Concurrent infrared imagery along the track enabled the floe size distribution to be recorded. A linear decay of wave energy with 'effective penetration' (distance penetrated multiplied by fractional ice cover) was found, the decay rate increasing with wave frequency. A simple theoretical model based on progressive reflection from rows of floes gave good agreement with the observations. (Author)

A76-16290 **Automatic sea ice detection in satellite pictures.** D. J. Gerson (U.S. Naval Oceanographic Office, Suitland, Md.) and A. Rosenfeld (Maryland, University, College Park, Md.). *Remote Sensing of Environment,* vol. 4, no. 3, 1975, p. 187-198. 24 refs. Navy-supported research; Contract No. F44620-72-C-0062.

Sea ice is easily discriminable from water on the basis of brightness, but it is harder to discriminate from clouds. This paper describes the use of statistical features to discriminate sea ice from clouds with 90% or greater accuracy. (Author)

N76-10540*# Geological Survey, Tacoma, Wash.
A LAKE AND SEA ICE EXPERIMENT WITH SKYLAB MICROWAVE RADIOMETRY Progress Report, Mar. 1975
William J. Campbell, Principal Investigator Mar. 1975 2 p EREP
(NASA Order T-4112-B)
(E76-10008; NASA-CR-119116) Avail: NTIS HC $3.25 CSCL 08L

N76-10543*# Geological Survey, Tacoma, Wash.
A LAKE AND SEA ICE EXPERIMENT WITH SKYLAB MICROWAVE RADIOMETRY *Progress Report, Dec. 1974*
William J. Campbell, Principal Investigator Dec. 1974 2 p EREP
(NASA Order T-4112-B)
(E76-10011; NASA-CR-119119) Avail: NTIS HC $3.25 CSCL 08L

N76-10544*# Geological Survey, Tacoma, Wash.
A LAKE AND SEA ICE EXPERIMENT WITH SKYLAB MICROWAVE RADIOMETRY Progress Report, Jun. 1975
William J. Campbell, Principal Investigator Sep. 1975 2 p EREP
(NASA Order T-4112-B)
(E76-10012; NASA-CR-119120) Avail: NTIS HC $3.25 CSCL 08L

N76-10546*# Mississippi Test Facility, Bay St. Louis.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Progress Report, 1-31 Aug. 1975
Kenneth J. Savastano 31 Aug. 1975 3 p EREP
(NASA Order T-8217-B)
(E76-10014; NASA-CR-119122; PR-20) Avail: NTIS HC $3.25 CSCL 08A

N76-10632# Defence Research Establishment Ottawa (Ontario).
INTERPRETATION OF SLAR IMAGERY OF ICE IN NARES STRAIT AND THE ARCTIC OCEAN
Moira Dunbar Jan. 1975 43 p refs
(AD-A011114; DREO-R-712) Avail: NTIS CSCL 08/12

SLAR imagery of Nares Strait was obtained on four flights carried out in January, March and August 1973, and April 1974 by Canadian Forces Maritime Proving and Evaluation Unit in an Argus aircraft equipped with a Motorola APS-94D SLAR. The March flight also covered two lines in the Arctic Ocean, from Alert to the pole and from the pole down the 4 degrees E meridian to the ice edge at about 80 degrees N. No observations on the ground were possible, but some back-up was available on all flights from visual observations recorded in the air, and on the March flight from infrared line-scan and vertical photography. The interpretation of ice features from the SLAR imagery is discussed, and the conclusion reached that in spite of certain ambiguities the technique has great potential which will increase with improving resolution. GRA

N76-11487* National Oceanic and Atmospheric Administration, Miami, Fla.
GEOSTROPHIC CURRENT INVESTIGATIONS WITH SEASAT
H. Michael Byrne and William O. VonArx (Woods Hole Oceanographic Inst.) *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 41-44
CSCL 08C

The measurement of sea surface topology by SEASAT satellite allows for the detection of baroclinic or barotropic geostrophic flows, as well as the tracking of cyclonic cold core rings generated by currents. It is stipulated that SEASAT is the only system capable of measuring pressure and motion fields of a sea surface reliably, synoptically, and at an affordable cost. G.G.

N76-11489* Naval Research Lab., Washington, D.C.
GEODETIC CORRECTIONS AND RELATED INFORMATION FROM OCEANOGRAPHIC MEASUREMENTS MADE BY SEASAT-A
Davidson Chen *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 47-49 refs
CSCL 08E

Oceanographic measurements taken by SEASAT-A are not only applicable to correct altimetry data for the desired geoid but also, as a result, they themselves are useful by-products for basic and applied research in the fields of sciences and engineering, exploratory development in sensor design and measurement techniques, and prediction products for operational fleet support. Among these measurements the important ones are current, sea state, and tides. Identified are parameters of the measurements which will be used to eliminate temporal environmental biases from geodetic measurements, and also to describe the physical processes involved. Author

N76-11491* Scripps Institution of Oceanography, La Jolla, Calif. Inst. of Geophysics and Planetary Physics.
OCEAN TIDES FROM SEASAT-A
M. C. Hendershott, W. H. Munk, and B. D. Zetler *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 54-56 refs

CSCL 08C

Two procedures for the evaluation of global tides from SEASAT-A altimetry data are elaborated: an empirical method leading to the response functions for a grid of about 500 points from which the tide can be predicted for any point in the oceans, and a dynamic method which consists of iteratively modifying the parameters in a numerical solution to Laplace tide equations. It is assumed that the shape of the received altimeter signal can be interpreted for sea state and that orbit calculations are available so that absolute sea levels can be obtained. Author

N76-11496* Naval Research Lab., Washington, D.C.
EXPLOITATION OF SEASAT-A OCEANOGRAPHIC MEASUREMENTS FOR NAVY R AND D APPLICATIONS
V. Noble *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 85-88
CSCL 08J

Basic research, exploratory development and operational demonstration potentials for exploitation of SEASAT-A data are discussed. Some of the interactions and tradeoffs in sensor design and measurement technology, and advanced development of environmental analysis and prediction products for operational fleet support are outlined. G.G.

N76-11497* City Coll. of the City Univ. of New York. Inst. of Oceanography.
THE SCIENTIFIC JUSTIFICATION FOR OBTAINING OCEAN WAVE DATA OF VARIOUS KINDS WITH SEASAT-A
Willard J. Pierson *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 89-94
(Contract NAS5-20041)
CSCL 08C

Synthetic aperture radar images of sea surface in deep water as well as two candidate instruments that essentially scan along a line are considered for obtaining spectral wave information with SEASAT-A. An altimeter provides data on wave height for every 50 or 100 kilometers along subsatellite track routine. A combination of these instruments is proposed to obtain wind generated ocean waves and swells. G.G.

N76-11499* Coast Guard, Washington, D.C. Oceanography Unit.
ADVANTAGES OF AN OCEANOGRAPHIC SATELLITE IN THE STUDY OF OCEAN CURRENT SYSTEMS
R. Q. Robe *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 99-100
CSCL 08C

SEASAT-A instruments for the study of oceanic currents are: a scanning radiometer with a temperature resolution of about + or - 1 C for locating ocean fronts by thermal difference, and a precision altimeter for monitoring sea surface slopes that drive major ocean currents. G.G.

N76-11500* Naval Research Lab., Washington, D.C.
COMMENTS ON NAVY/NRL REQUIREMENTS FOR SEA SURFACE TEMPERATURE AND SURFACE WIND MEASUREMENTS ON SEASAT-A
R. E. Ruskin and R. K. Jeck, Jr. *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 101-102

CSCL 08J

SEASAT instrumentation payload requirements to provide satellite data for the Navy fleet operational fog prediction program include: (1) some form of C-band microwave radiometer capability; (2) a scanning antenna with a 40-km Instanteneous Field of View (IFOV) for the C-band channel; (3) a narrow band and high resolution IR scanning radiometer for cloud free areas; and (4) a capability for measuring surface winds of 3 to 50 m/sec at + or - 10% accuracy and 50 to 100 km spatial resolution. G.G.

N76-11501* Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
ON THE REMOTE SENSING OF DIRECTIONAL WAVE SPECTRA AND SURFACE WINDS
O. H. Shemdin *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 103-108 refs
02-42)
CSCL 08C

The potential benefits of remote SEASAT-A satellite sensing of wind directional wave spectra by active microwave systems are elaborated. It is shown that a combined effort which uses supplemental satellite information in numerical forecasting and hindcasting schemes upgrades the accuracy of existing forecasting methods of an order of magnitude. G.G.

N76-11502* National Environmental Satellite Service, Washington, D.C.
MICROWAVE MEASUREMENT OF SEA SURFACE TEMPERATURE
John W. Sherman, III and P. Kirshna Rao *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 109-123 refs

CSCL 08J

SEASAT-A microwave radiometry is considered for scientific studies related to sea surface temperature measurements. Its limited swath width negates certain studies at angles greater than about 30 deg from nadir. Symmetrical scans appear best for operational experiments. It is recommended that a mode of scan be incorporated which permits data to be collected from nadir up to 11 55-60 deg from nadir, even if a symmetrical scan is necessary. G.G.

N76-11504* Scripps Institution of Oceanography, La Jolla, Calif.
SATELLITE MEASUREMENTS OF OCEAN WAVES
Robert H. Stewart *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 126-127 ref
02-42)
CSCL 08C

Satellite measurements of the directional spectrum of ocean waves are beneficial to theoretical wave research, ocean engineering, and marine activities. Wave measurements from satellites by active microwave systems also help to analyze those processes that govern the transfer of heat, water vapor, and momentum across the air-sea interface. G.G.

N76-11505* Florida State Univ., Tallahassee.
PHYSICAL OCEANOGRAPHY FROM SATELLITES: CURRENTS AND THE SLOPE OF THE SEA SURFACE
W. Sturges *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 128 refs
CSCL 08J

A global scheme using satellite altimetry in conjunction with thermometry techniques provides for more accurate determinations of first order leveling networks by overcoming discrepancies between ocean leveling and land leveling methods. The high noise content in altimetry signals requires filtering or correction for tides, etc., as well as carefully planned sampling schemes. G.G.

N76-11507* Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SEASAT AND FLOATING ICE
W. F. Weeks *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 134-135
CSCL 08L

Data collected by SEASAT would be useful in developing predictive physical models for the drift and deformation of sea ice, for estimating the heat budget of the polar seas, for the optimum routing of shipping through pack ice areas, for the design of both offshore structures and shipping capable of surviving in heavy pack ice, and for the tracking of large icebergs and ice islands. The instrument package for SEASAT-A is particularly useful for studying sea ice in that the Coherent Imaging Radar (CIR), the Scanning Multifrequency Microwave Radiometer (SMMR) and the Compressed Pulse Radar Altimeter (CPRA) are not limited by the presence of clouds. Author

N76-11508* National Aeronautics and Space Administration, Washington, D.C.
THE EARTH AND OCEAN PHYSICS APPLICATIONS PROGRAM (EOPAP). OCEAN DYNAMICS PROGRAM
John R. Apel (NOAA) and Joseph W. Siry *In its* Seasat-A Sci. Contrib. Jul. 1974 p 139-151 refs

CSCL 08E

SEASAT-A is a research oriented program consisting of a spacecraft, precision ground tracking systems, and data processing and modelling capabilities that address both scientific and application programs problems in ocean surface dynamics for the EOPAP program. An array of active radar and passive microwave and infrared instruments allows for quantitative measurements of oceanic, atmospheric, and geodetic parameters under stormy wind and wave conditions, as well as over regions lying under a cloud cover. G.G.

N76-11514 Joint Publications Research Service, Arlington, Va.
FUTURE POSSIBILITY OF INVESTIGATING THE OCEAN USING ARTIFICIAL SATELLITES
K. N. Fedorov and V. Ye. Sklyarov *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 36-48 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 13 p

The temperature field and level changes of the ocean surface were measured by remote sensors onboard artificial satellites. Radars and lasers were found promising for measuring waves. Ice cover, coastal zones, ocean bottom, and buoys are also being studied by satellite sensors. J.A.M.

N76-11528*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COASTAL PROCESSES STUDY: SKYLAB Final Report, May 1973 - Jun. 1975
Douglas M. Pirie and David D. Steller, Principal Investigators (Geosource Inc., Long Beach, Calif.) Jun. 1975 74 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order A-85918-A)
(E76-10030; NASA-CR-144489) Avail: NTIS HC $4.50 CSCL 08J

The author has identified the following significant results. In San Pablo Bay, the patterns of dredged sediment discharges were plotted over a three month period. It was found that lithogenous particles, kept in suspension by the fresh water from the Sacramento-San Joaquin, were transported downstream to the estuarine area at varying rates depending on the river discharge level. Skylab collected California coastal imagery at limited times and not at constant intervals. Resolution, however, helped compensate for lack of coverage. Increased spatial and spectral resolution provided details not possible utilizing Landsat imagery. The S-192 data was reformatted; band by band image density stretching was utilized to enhance sediment discharge patterns entrainment, boundaries, and eddys. The 26 January 1974 Skylab 4 imagery of San Francisco Bay was taken during an exceptionally high fresh water and suspended sediment discharge period. A three pronged surface sediment pattern was visible where the Sacramento-San Joaquin Rivers entered San Pablo Bay through Carquinez Strait.

N76-11817* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE REMOTE SENSING OF OCEANS, CHAPTER 3
In its Active Microwave Workshop Report 1975 p 157-162

CSCL 08J

A rationale is developed for the use of active microwave sensing in future aerospace applications programs for the remote sensing of the world's oceans, lakes, and polar regions. Summaries pertaining to applications, local phenomena, and large-scale phenomena are given along with a discussion of orbital errors. Author

N76-11820* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE-SCALE PHENOMENA, CHAPTER 3, PART D
In its Active Microwave Workshop Report 1975 p 192-220

CSCL 08J

Oceanic phenomena with horizontal scales from approximately 100 km up to the widths of the oceans themselves are examined. Data include: shape of geoid, quasi-stationary anomalies due to spatial variations in sea density and steady current systems, and the time dependent variations due to tidal and meteorological forces and to varying currents. Author

N76-12430*# Delaware Univ., Newark. Coll. of Marine Studies.
THE INFLUENCE OF COASTAL FRONTS ON THE MOVEMENT AND DISPERSION OF OIL SLICKS
V. Klemas, Principal Investigator, G. Davis, and S. Kupferman 25 Oct. 1975 2 p ERTS
(Contract NAS5-20983)
(E76-10041; NASA-CR-145581) Avail: NTIS HC $3.50 CSCL 08C

The author has identified the following significant results. LANDSAT, aircraft, and boats were used successfully to study estuarine and coastal fronts or boundaries. Fronts are a major hydrographic feature in Delaware Bay and in other estuaries. Horizontal salinity gradients of 4% in one meter and convergence velocities of the order of 0.1 m/sec were observed. Visibility improved from one meter to two meters as certain boundaries were crossed. Fronts near the mouth of the bay are associated with the tidal exchange with shelf water. The formation of fronts in the interior of the bay appears to be associated with velocity shears induced by differences in bottom topography with horizontal density difference in the deep water portion of the estuary. Surface slicks and foam collected at frontal convergence zones near boundaries were found to contain concentrations of Cr, Cu, Fe, Hg, Pb, and Zn higher by two to four orders of magnitude than concentrations in mean ocean water.

N76-12431*# Delaware Univ., Newark. Coll. of Marine Studies.
STUDIES OF CURRENT CIRCULATION AT OCEAN WASTE DISPOSAL SITES
V. Klemas, Principal Investigator, G. Davis, and R. Henry 23 Oct. 1975 2 p ERTS
(Contract NAS5-20983)
(E76-10042; NASA-CR-145582) Avail: NTIS HC $3.50 CSCL 08C

The author has identified the following significant results. Circulation processes at the acid waste disposal site are highly event-dominated, with the majority of the water transport occurring during strong northeasters. There is a mean flow to the south

alongshore. This appears to be due to the fact that northeasterly winds produce stronger currents than those driven by southeasterly winds and by the thermohaline circulation. During the warm months, the ocean stratifies with warm water over cold water. A distinct thermocline was observed with expendable bathythermographs during all summer cruises at depths ranging from 10 to 21 meters. During stratified conditions, the near-bottom drogues showed very little movements. The duPont waste plume was observed in LANDSAT satellite imagery during dump up to 54 hours after dump.

N76-12433*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Progress Report, Jul. - Oct. 1975
V. Klemas, Principal Investigator, D. Bartlett, W. Philpot, and G. Davis 24 Oct. 1975 7 p refs ERTS
(Contract NAS5-20983)
(E76-10044; NASA-CR-145584) Avail: NTIS HC $3.50 CSCL 08A

The author has identified the following significant results. The duPont waste disposal plume was observed in 12 NASA/LANDSAT satellite images during dump up to 54 hours after dump. The circulation processes at the acid waste disposal site are highly event-dominated, with the majority of the water transport occurring strong northeasters. There is a mean flow to the south alongshore. During the warm months, the ocean stratifies with warm water over cold water. During stratified conditions, the near-bottom drogues showed very little movement. LANDSAT, aircraft, and boats were used successfully to study estuarine and coastal fronts or boundaries. By capturing and holding oil slicks, frontal systems significantly influence the movement and dispersion of oil slicks in Delaware Bay. Recent oil slick tracking experiments conducted to verify a predictive oil dispersion and movement model have shown that during certain parts of the tidal cycle the oil slicks tend to line up along boundaries.

N76-12435*# Delaware Univ., Newark. Coll. of Marine Studies.
COASTAL ZONE CLASSIFICATION FROM SATELLITE IMAGERY
V. Klemas, R. Rogers, Principal Investigators (Bendix Corp., Ann Arbor), D. Bartlett, and L. Reed (Bendix Corp., Ann Arbor) 27 Oct. 1975 2 p ERTS
(Contract NAS5-20983)
(E76-10046; NASA-CR-145586) Avail: NTIS HC $3.50 CSCL 08J

The author has identified the following significant results. Studies of cover distribution along Delaware's coast, especially in tidal wetlands, were made utilizing semi-automated analysis of LANDSAT-1 MSS digital data. Cover maps with eleven vegetation and other cover categories were produced with accuracy of identification above 80% in all categories. Recent studies have tested a new technique for training automated analysis which uses ground measured reflectance and atmospheric correction techniques to derive signatures for specific categories in preference to the relative radiance signatures derived from training sets within the LANDSAT data itself. Initial tests using a four category scheme indicate that training data based on absolute measured reflectance and atmospheric correction of LANDSAT data can produce comparable accuracy of categorization to that achieved using more conventional relative radiance training.

N76-12445*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF REMOTE SENSORS IN COASTAL ZONE OBSERVATIONS
Jean-Michael Caillat, Charles Elachi, and Walter E. Brown, Jr. 15 Nov. 1975 65 p refs
(Contract NAS7-100)
(NASA-CR-145792; JPL-TM-33-750) HC $4.50 CSCL 08B

A review of processes taking place along coastlines and their biological consideration led to the determination of the elements which are required in the study of coastal structures and which are needed for better utilization of the resources from the oceans. The processes considered include waves, currents, and their influence on the erosion of coastal structures. Biological considerations include coastal fisheries, estuaries, and tidal marshes. Various remote sensors were analyzed for the information which they can provide and sites were proposed where a general ocean-observation plan could be tested. Author

N76-12460# Washington Univ., Seattle. Arctic Ice Dynamics Joint Experiment Office.
AIDJEX BULLETIN NUMBER 28
Nov. 1974 184 p refs
(Contract NSF C-625)
(PB-242435/6; AIDJEX-75-28) Avail: NTIS HC $7.50 CSCL 08L

Projects undertaken during the 1975-1976 AIDJEX main experiment (meteorology, air stress, oceanography, ocean and ice melt are described. Other topics discussed include: progress and problems with the AIDJEX numerical model; data analysis; and the possibility of using geostationary satellites for communication in polar regions. GRA

N76-13549*# Helsinki Univ. (Finland).
ICE INVESTIGATIONS USING LANDSAT-2 IMAGERY Quarterly Report
Erkki Palosuo, Principal Investigator 1975 10 p Sponsored by NASA ERTS
(E76-10062; NASA-CR-145754; QR-1) Avail: NTIS HC $3.50 CSCL 08L

N76-13557*# Alaska Univ., Fairbanks.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA
William J. Stringer, Principal Investigator [1975] 5 p refs Sponsored by NASA ERTS
(E76-10070; NASA-CR-145762; QPR-2) Avail: NTIS HC $3.50 CSCL 08J

The author has identified the following significant results. Comparison of late season U-2 color infrared sea ice photography and early ice season LANDSAT sea ice imagery has made possible the identification of subtle features seen on early season LANDSAT imagery in the near shore areas. The U-2 imagery positively linked these features to ice conditions generally not observable by LANDSAT because of the time of year when they take place. Ice formed in place largely as single sheets appears light while ice deformed by considerable rafting appears darker when viewed on LANDSAT imagery. Because the ice is snow-covered at the time this imagery is obtained, this underlying structure must be revealed by the topography of the snow surface, and the resulting light scattering characteristics.

N76-13710# Earth Satellite Corp., Washington, D.C.
APPLICATIONS OF THE NIMBUS 5 ESMR TO RAINFALL DETECTION OVER THE OCEANS AND TO SEA-ICE DETECTION Final Report
Romeo R. Sabatini, Dennis L. Hlavka, and Ronald Arcese Apr. 1975 81 p refs
(Contract N66314-73-C-1572)
(AD-A013245; EPRF-TR-6-75(ESC)) Avail: NTIS CSCL 04/2

The report explores the applicability of the Nimbus 5 Electrically Scanning Microwave Radiometer (ESMR) to rainfall detection over the oceans and to sea ice detection. Two different but complementary approaches are taken - a theoretical approach which involved the theoretical calculations of brightness temperature (t sub b) in a prepared scenario of model atmospheres and surface conditions, and an empirical approach which made use of simultaneous measurements of our parameters of interest from other sensors: WSR-57 radar for precipitation, and images from other satellites (NOAA and LANDSAT) for sea-ice. GRA

N76-13714# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
CATALOG OF TIDAL INLET AERIAL PHOTOGRAPHY Final Report
John H. Barwis Jun. 1975 180 p ref
(AD-A012798; AEWES-GITI-75-2) Avail: NTIS CSCL 08/6

Data on approximately 6000 aerial photographic coverages of tidal inlets are presented in tabular form, along with information on how any given photograph may be obtained. The compilation covers inlets along the Atlantic, Gulf, and Pacific coasts of the contiguous U.S. coastline from 1938 to 1974, and includes the following information: (1) Inlet name; (2) Geographic coordinates; (3) National Ocean Survey navigation chart covering inlet; (4) Georef grid square; (5) Month and year of photography; (6) Federal, state, or commercial agency holding film; (7) Project number; (8) Pertinent exposure numbers; (9) Scale; and (10) Film type. Information is also given on sources of additional photography, and on obtaining photography of beach areas between any two inlets. An index, by Corps of Engineer District, is given. Author (GRA)

N76-14563*# Mississippi Test Facility, Bay St. Louis.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Progress Report, 1 Sep. - 15 Nov. 1975
Kenneth J. Savastano, Principal Investigator 25 Nov. 1975 3 p EREP
(NASA Order T-8217-B)
(E76-10080; NASA-CR-145885; PR-20) Avail: NTIS HC $3.50 CSCL 08A

N76-14566*# Norsk Polarinstitutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Quarterly Report
Torgny E. Vinje, Principal Investigator 11 Nov. 1975 3 p Sponsored by NASA and Roy. Norwegian Council for Sci. and Indust. Res. ERTS
(E76-10083; NASA-CR-145870; QR-1) Avail: NTIS HC $3.50 CSCL 08L

N76-15523# Washington Univ., Seattle. Arctic Ice Dynamics Joint Experiment Office.
AIDJEX BULLETIN NUMBER 29
Jul. 1975 185 p refs
(Contract NSF C-625)
(PB-244424/8; AIDJEX-75-29) Avail: NTIS HC $7.50 CSCL 08L

Much of AIDJEX Bulletin No. 29 is devoted to further discussion of the AIDJEX sea ice model. In particular the ice-ocean momentum transfer, the planetary boundary layer parameters, and the effect of changing the yield surface are discussed. The remote sensing plan for the AIDJEX main experiment field operations from late February to early June is also included. Other articles deal with using ERTS photographs to test ice thickness redistribution, measuring the turbulent boundary layer under pack ice, and modeling the seasonal ablation and accretion of Antarctic sea ice. GRA

N76-15556*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH AND OCEAN DYNAMICS SATELLITES AND SYSTEMS
F. O. Vonbun Nov. 1975 34 p refs Presented at Intern. Astronautical Federation (IAF) 26th Congr., Lisbon, 21-27 Sep. 1975
(NASA-TM-X-71026; X-900-75-287) Avail: NTIS HC $4.00 CSCL 08E

An overview is presented of the present state of satellite and ground systems making observations of the dynamics of the solid earth and the oceans. Emphasis is placed on applications of space technology for practical use. Topics discussed include: satellite missions and results over the last two decades in the areas of earth gravity field, polar motions, earth tides, magnetic anomalies, and satellite-to-satellite tracking; laser ranging systems; development of the Very Long Baseline Interferometer; and Skylab radar altimeter data applications. J.M.S.

N76-15558# Environmental Research and Technology, Inc., Concord, Mass.
MAPPING OF SEA SURFACE TEMPERATURE BY THE DMSP SATELLITE Final Report
James L. Cogan and James H. Willand May 1975 83 p refs (EPRF Proj. 66856)
(AD-A014427; ERT-1065-F; EPRF-7-75(ERT)) Avail: NTIS CSCL 08/10

Sea surface temperature (T2) may be inferred from Defense Meteorological Satellite Program (DMSP) satellite measurements of infrared radiances in atmospheric windows if errors in instrumentation, data processing, and satellite orientation are properly accounted for. Even in the absence of clouds, the slight opacity of the atmosphere in the windows causes the temperature 'seen' by the satellite to be lower than that measured by ships or aircraft. Clouds produce the same effect, but generally of a greater magnitude. GRA

N76-15559# University of Southern Calif., Los Angeles. Dept. of Geological Sciences.
APPLICATIONS OF ERTS IMAGERY AND SHIPBOARD OBSERVATIONS TO COASTAL ENVIRONMENTS STUDIES. PART 1: HYPERSALINE ENVIRONMENTS. PART 2: COASTAL CIRCULATION ANALYSIS Final Technical Report, 1 Jan. - 31 Dec. 1974
Donn. S. Gorsline, Stephen P. VonderHaar, and Corla C. Davis Aug. 1975 45 p refs
(Contract N00014-67-A-0269-0009; NR Proj. 388-108)
(AD-A014570; USC-GEOL-76-1-Pt-1/2) Avail: NTIS CSCL 08/3

Work done during the 1974 included a study of the wetting cycles on tidal and supra-tidal coastal areas of Baja California in arid climatic conditions. Progress on ERTS (LANDSAT) imagery analysis as a basis for describing coastal water circulation patterns includes collection of oceanographic data on water transparency and suspended sediment concentrations from shipboard on the date of satellite passage and comparison of patterns with general circulation as defined by standard oceanographic surveys (source data is from California Cooperative Fisheries Project and from field work aboard R. V. VELERO IV of the University of Southern California). Data show that the satellite imagery gives a higher degree of detail than the ship observations due to the time required for ship traverses and stations and the consequent limitations of resolution. GRA

N76-15734*# Kansas Univ., Lawrence. Space Technology Labs.
TOWARD PROOF OF SATELLITE ANEMOMETER CONCEPT Final Report, 1 Dec. 1972 - 30 Jun. 1973
John Classen 30 Jun. 1973 13 p refs
(Contract NAS9-13356)
(NASA-CR-146076) Avail: NTIS HC $3.50 CSCL 14B

The S-193 oceanographic program is designed to demonstrate the operational feasibility of measuring ocean surface winds on a global basis with a composite radar-radiometer sensor. Near-simultaneous radiometric/scatterometric measurements offer a better opportunity to make improved estimates of surface winds through a variety of atmospheric conditions. Support is presented in developing interpretational techniques for the joint measurements, designing experiments to verify the joint interpretation techniques, predicting the observations from theory, evaluating system effects on the measurements, and developing system design criteria. Author

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A76-10150 * **Break-up characteristics of the Chena River watershed, Central Alaska.** G. Wendler, R. Carlson, and D. Kane (Alaska, University, College, Alaska). In: Advanced concepts and techniques in the study of snow and ice resources. Washington, D.C., National Academy of Sciences, 1974, p. 523-531. 10 refs. Contract No. NAS5-21833.

The snow melt for a small watershed (5130 sq km) in Central Alaska was successfully monitored with ERTS imagery. Aerial photography was used as supporting data for periods without satellite coverage. Comparison both with actual measurements and with a computer model showed good agreement. (Author)

A76-12639 **Symposium on Remote Sensing in Glaciology, Cambridge, England, September 16-20, 1974, Proceedings.** Symposium sponsored by the International Glaciological Society. *Journal of Glaciology*, vol. 15, no. 73, 1975. 484 p.

Papers are presented describing applications of remote sensing techniques, including radar techniques, laser techniques, thermal infrared sensing, multispectral scanning, and sonar, in the study of glaciers, sea ice, pack ice, and other glaciological phenomena. Some of the topics covered include theory of radio echoes from glacier beds, ultrasonic properties of plastically deformed ice, comparison of sea ice type identification between airborne dual-frequency passive microwave radiometry and standard laser/infrared techniques, analysis of the near-surface energy transfer environment from thermal infrared imagery, the optical properties of salt ice, and the use of ERTS images to measure the movement and deformation of sea ice.

P.T.H.

A76-12640 # **Radio-echo sounding - Glaciological interpretations and applications.** G. Robin (Scott Polar Research Institute, Cambridge, England). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology*, vol. 15, no. 73, 1975, p. 49-63; Discussion, p. 63, 64. 49 refs.

Factors affecting the refraction, absorption, and reflection of radio waves in ice masses are reviewed. The utility of radio echo methods in obtaining data for plotting profiles of the bedrock and upper surfaces of polar, sub-polar, and temporate ice sheets is assessed. Results of investigations of large ice masses tend to confirm current general ideas concerning the interaction of temperature and flow in large ice sheets; problems encountered in the study of temporate glaciers are probably due to the irregular dielectric properties of the ice masses, indicative of an irregular distribution of water. Suggestions are made regarding adaptation of radio-echo instrumentation and techniques to measuring the rate of accumulation and the ablation of ice sheets and shelves, and their future use in determining the distribution of temperature and velocity of motion within the ice mass. C.K.D.

A76-12641 # **Comparison of electromagnetic and seismic-gravity ice thickness measurements in east Antarctica.** D. J. Drewry (Scott Polar Research Institute, Cambridge, England). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology*, vol. 15, no. 73, 1975, p. 137-149; Discussion, p. 150. 41 refs.

A76-12642 # **Application of radar techniques to ice and snow studies.** D. F. Page (Department of Communications, Communications Research Centre, Ottawa, Canada) and R. O. Ramseier (Department of the Environment, Ottawa, Canada). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology*, vol. 15, no. 73, 1975, p. 171-191. 45 refs.

This paper presents an overview of the active microwave tools becoming available to the glaciologist with emphasis on recent radar developments as applied to floating ice. Sufficient theory is presented for the user to understand the techniques. Side-looking radar imagery is discussed using a number of examples resulting from the use of real and synthetic aperture, single and dual polarization. Recent studies of the microwave properties of ice and snow are reviewed, and are shown to be leading to significant advances in high-resolution radar techniques for accurate sounding of these materials. Remote sensing of fresh-water ice thickness is shown to be well established and operational, with similar techniques feasible in the near future for sea ice. It is pointed out that both imaging and probing radars applied to studies of sea ice and snow usually must be used in association with data from other sensors. (Author)

A76-12644 # **Sea-ice reconnaissance by radar.** T. Tabata (Hokkaido University, Sapporo, Japan). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology*, vol. 15, no. 73, 1975, p. 215-223; Discussion, p. 224. 10 refs.

To observe the distribution of pack ice off the coast of the Okhotsk Sea coast of Hokkaido, a radar network consisting of three radar stations was constructed during 1967-69. It covers an area about 70 km wide and 250 km long. The stations are remote-controlled by radio from the Sea Ice Research Laboratory and the information obtained is transmitted back to the laboratory and observed there. Radar has the great advantage of being able to make continuous observations of ice. Usually several special features can be seen on the radar screen, and they are used as markers for the observation of movement. It is ascertained that the average pattern of drift in this area is from north to south-east along the coast line and the ice field undergoes internal deformation during its drift. To get some information on the surface topography of ice from A-scope radar, the intensity of echo signals is classified into 16 steps by computer. To obtain the movement of an ice field from the numerical radar information, a modified two-dimensional cross-correlation method was tested. (Author)

A76-12647 # **Application of remote-sensing techniques to the study of seasonal snow cover.** M. F. Meier (U.S. Geological Survey, Tacoma, Wash.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology*, vol. 15, no. 73, 1975, p. 251-265; Discussion, p. 265. 34 refs.

This paper discusses the measurement of important snow properties using electromagnetic radiation. Snow areal extent can be measured using manual, optical, electronic, or digital techniques from data supplied by visible and near-visible light sensors carried on earth resources and meteorological satellites, but these techniques cannot routinely detect snow under clouds or a forest canopy. Gamma-ray techniques used at stations or from low-flying aircraft permit measurement of water equivalent of snow (depth times density). Active or passive microwave systems may permit this to be done over larger areas, but the physics of this possible technique is not yet sufficiently understood. Wetness or temperature of a snow surface is measurable with thermal infrared radiometers; wetness throughout a snow pack may be measurable with microwave radiometers. Much research needs to be done on the electrical (including scattering) properties of snow before efficient, all-weather, remote-sensing systems can be designed. (Author)

A76-12653 # **Glacier applications of ERTS images.** R. M. Krimmel and M. F. Meier (U.S. Geological Survey, Tacoma, Wash.). *(International Glaciological Society, Symposium on Remote Sensing*

in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology, vol. 15, no. 73, 1975, p. 391-401; Discussion, p. 402.

Long-term surface velocities are readily determined by comparison of recent ERTS images with maps that have been produced from earlier data. Images have been used to measure velocities on the Malaspina Glacier over a 10 year period, surge displacements on the Lowell, Tenas Tikke, and Tweedsmuir Glaciers and Lednik Medvezhiy, and velocity at the margin of the Hubbard Glacier. Many surging glaciers are readily identifiable on the images. Coverage from the satellite will allow surging glaciers to be identified world-wide which may help glaciologists to understand their peculiar geographical distribution. Images of large glaciers taken under conditions of low sun angle and complete snow cover show previously undetected subtle slope changes which can be interpreted as dynamic flow features or reflections of subglacial topography. (Author)

A76-16210 **Determination of groundwater inflow to prairie lakes using remote sensing.** J. M. Whiting (Saskatchewan Research Council, Saskatoon, Canada). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 60-65. 9 refs.

This study was designed to find the locations in Big Quill Lake, Saskatchewan, where the transfer of surficial and aquifer groundwater occurs in the lake bed. Using the findings of a geological survey done between 1966 and 1969, and combining the results of the remote-sensing techniques of LANDSAT-1 airborne radio phase detection (E-PHASE) and infrared line-scanning, it proved possible to locate nine areas at which inflow of groundwater is assumed to take place. Together these nine locations comprise an area of four square kilometers in a lake that covers 250 square kilometers. In addition, it was possible to separate these nine groundwater locations from such *dynamic events as spiral currents (a tenth anomaly zone)* and peninsula-building bottom currents. (Author)

A76-17570 **Contactless radar mapping of warm valley glaciers - Transformation of radar coordinates.** V. S. Luchininov (Leningradskii Elektrotekhnicheskii Institut, Leningrad, USSR). *(Zhurnal Tekhnicheskoi Fiziki,* vol. 45, Apr. 1975, p. 883-891.) *Soviet Physics - Technical Physics,* vol. 20, no. 4, 1976, p. 556-560. 6 refs. Translation.

A76-18512 * # **Remote profiling of lake ice using an S-band short-pulse radar aboard an all-terrain vehicle.** D. W. Cooper, R. A. Mueller, and R. J. Schertler (NASA, Lewis Research Center, Cleveland, Ohio). *International Union of Radio Science Meeting, Boulder, Colo., Oct. 20-23, 1975, Paper.* 18 p. 13 refs.

The airborne short-pulse radar system described was developed to measure ice thickness in an attempt to extend the winter navigation system as a means of reducing coal and ore shipping costs. Experimental studies of the accuracy and limitations of the system are discussed, and measurements made at 25 sites are compared. The radar system was found to provide accurate lake ice thickness measurements that were not affected by snow cover or adverse weather conditions. Surface melting and rain, however, preclude measurements. V.P.

N76-10533*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE COLORADO Interim Report, Jun. - Aug. 1975
Daniel H. Knepper, Principal Investigator, J. D. Ives, and R. Summer Aug. 1975 30 p refs ERTS
(Contract NAS5-20914)
(E76-10001; NASA-CR-119108) Avail: NTIS HC $3.75 CSCL 08L

The author has identified the following significant results. Interpretation of small scale LANDSAT imagery provides a means for determining the general location and distribution of avalanche paths. The accuracy and completeness of small scale mapping is less than is obtained from the interpretation of large scale color infrared photos. Interpretation of enlargement prints (18X) of LANDSAT imagery is superior to small scale imagery, because more detailed information can be extracted and annotated.

N76-10542*# Delaware Univ., Newark. Coll. of Marine Studies.
MONITORING ESTUARINE CIRCULATION AND OCEAN WASTE DISPERSION USING AN INTEGRATED SATELLITE-AIRCRAFT-DROGUE APPROACH
V. Klemas, Principal Investigator, G. Davis, and H. Wang 30 Oct. 1975 2 p ERTS
(Contract NAS5-20983)
(E76-10010; NASA-CR-119118) Avail: NTIS HC $3.25 CSCL 08C

The author has identified the following significant results. An inexpensive, integrated drogue-aircraft-satellite approach was developed which is based on the Lagrangian technique and employs remotely tracked drogues and dyes together with satellite observation of natural tracers, such as suspended sediment. Results include current circulation studies in Delaware Bay in support of an oil slick movement model; investigations of the dispersion and movement of acid wastes dumped 40 miles off the Delaware coast; and coastal current circulation. In each case, the integrated drogue-aircraft-satellite approach compares favorably with other techniques on the basis of accuracy, cost effectiveness, and performance under severe weather conditions.

N76-11523*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
ANALYSIS OF RIVER MEANDERS FROM ERTS-1 IMAGERY Final Report, 29 Aug. 1972 - 14 Jul. 1973
Robert N. Colwell, Gerald Schubert, and Richard Lingelfelter, Principal Investigators 14 Jul. 1973 118 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E76-10025; NASA-CR-145418) Avail: NTIS HC $5.50 CSCL 08H

N76-11543*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING WATER QUALITY FROM LANDSAT
John L. Barker Jul. 1975 40 p
(NASA-TM-X-71006; X-923-75-190) Avail: NTIS HC $4.00 CSCL 13B

Water quality monitoring possibilities from LANDSAT were demonstrated both for direct readings of reflectances from the water and indirect monitoring of changes in use of land surrounding Swift Creek Reservoir in a joint project with the Virginia State Water Control Board and NASA. Film products were shown to have insufficient resolution and all work was done by digitally processing computer compatible tapes. Land cover maps of the 18,000 hectare Swift Creek Reservoir watershed, prepared for two dates in 1974, are shown. A significant decrease in the pine cover was observed in a 740 hectare construction site within the watershed. A measure of the accuracy of classification was obtained by comparing the LANDSAT results with visual classification at five sites on a U-2 photograph. Such changes in land cover can alert personnel to watch for potential changes in water quality. Author

N76-11657 Field Science Office for Africa, Nairobi (Kenya).
NATURE CONSERVATION AND WATER RESOURCES: ASPECTS OF THE HIGHLANDS OF EASTERN AFRICA

Kai Curry-Lindahl *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 120-131 refs

Copyright.

The environmental conditions governing the water resources of the highlands of east Africa are described. The impact of crop cultivation on the highlands is considered, and the extent to which this threatens the water resources as well as the other natural renewable resources such as soil, vegetation, and wild animals is discussed. ESA

N76-11658 East African Agricultural and Forestry Research Organization, Muguga (Kenya).

THE WATER BALANCE OF CATCHMENTS IN THE HIGHLANDS OF KENYA

K. A. Edwards *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 132-151 refs

Copyright.

The major water balance problems of the Kenyan highlands are identified, and the need and design of water catchment areas are discussed. The sources for the catchment such as rainfall, runoff, evaporation, soil moisture and ground water are considered together with methods of calculating the yield. The operation of a network of catchments is noted. ESA

N76-11814* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

WATER RESOURCES, CHAPTER 2, PART B

In its Active Microwave Workshop Report 1975 p 67-97

CSCL 08H

Various applications and projected applications of active microwave instruments for studying water resources. Most applications involve use of an imaging system operating primarily at wavelengths of less than 30 cm (i.e., K-, X-, and L-bands). Discussion is also included concerning longer wavelength nonimaging systems for use in sounding polar glaciers and icecaps (e.g., Greenland and the Antarctic). The section is divided into six topics: (1) stream runoff, drainage basin analysis, and floods, (2) lake detection and fluctuating levels, (3) coastal processes and wetlands, (4) seasonally and permanently frozen (permafrost) ground, (5) solid water resources (snow, ice, and glaciers), and (6) water pollution. Author

N76-11819* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LOCAL PHENOMENA, CHAPTER 3, PART C

In its Active Microwave Workshop Report 1975 p 181-191

CSCL 08J

Oceanic and coastal phenomena with dimensions ranging to 100 km are dealt with. The two major categories discussed are waves, their generation and dynamics and ocean-land related problems. The dynamics, of surface waves in both capillary and gravity ranges indicates that microwave technology provides a superior means of measuring simultaneously the spatial and temporal properties of ocean waves. The need for basic studies of physical phenomena in support of active microwave sensing is indicated. Active microwave scattering from surface waves is discussed in terms of wave dynamics. Author

N76-12434*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF EUTROPHICATION IN SAGINAW BAY

Robert H. Rogers, Principal Investigator Oct. 1975 13 p refs Presented at 10th Intern. Symp. on Remote Sensing of Environ., Ann Arbor, Mich., 6-10 Oct. 1975 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-20942)

(E76-10045; NASA-CR-145585; BSR-4201) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. LANDSAT digital data and ground truth measurements for Saginaw Bay (Lake Huron), Michigan, for 3 June 1974 can be correlated by stepwise linear regression technique and the resulting equations used to estimate invisible water quality parameters in nonsampled areas. Correlation of these parameters with each other indicates that the transport of Saginaw River water can now be traced by a number of water quality features, one or more of which are directly detected by LANDSAT. Five of the 12 water quality parameters are best correlated with LANDSAT band 6 measurements alone. One parameter (temperature) relates to band 5 alone and the remaining six may be predicted with varying degrees of accuracy from a combination of two bands (first band 6 and generally band 4 second).

N76-12436*# Army Construction Engineering Research Lab., Champaign, Ill.

EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVIOR ON THE ENVIRONMENT AND ECOLOGY Progress Report, 1 Jul. - 30 Sep. 1975

R. K. Jain, Principal Investigator 30 Sep. 1975 2 p ERTS (E76-10047; NASA-CR-145587) Avail: NTIS HC $3.50 CSCL 13B

N76-12438*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.

INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN Progress Report, 1 Jun. - 30 Nov. 1973

G. J. McMurtry and G. W. Petersen, Principal Investigators Dec. 1973 19 p refs ERTS

(Contract NAS5-23133)

(E76-10049; NASA-CR-145589) Avail: NTIS HC $3.50 CSCL 08H

N76-12441*# Arkansas Univ., Fayetteville.

TECTONIC STRUCTURE OF ALASKA AS EVIDENCED BY ERTS IMAGERY AND ONGOING SEISMICITY Progress Report, 31 Oct. 1975

Larry D. Gedney, Principal Investigator 31 Oct. 1975 10 p refs ERTS

(Contract NAS5-20803)

(E76-10053; NASA-CR-145593) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. A mosaic was constructed from selected portions of eleven LANDSAT images at a scale of 1:1,000,000. Band 7 images were utilized because of their superior haze-cutting characteristics. The area is clearly dominated by two principal features; these are the Denali and Castle Mountain-Fairweather fault systems which traverse the mosiac from east to west near the northern and sourthern margins. An interesting feature is the apparent graben formed by the western flanks of the Talkeetna and Chugach Ranges, and the eastern flank of the Alaska Range. The most significant aspect to the mosaic is a dominant NE-SW striking structural grain of the Talkeetna Mountains-Alaska Range complex.

N76-12459# Northern Great Plains Resource Program, Denver, Colo.

NORTHERN GREAT PLAINS RESOURCE PROGRAM, WATER WORK GROUP REPORT

Dec. 1974 333 p Sponsored by Dept. of Agriculture, Dept. of Interior and EPA

(PB-243150/0; NGPRP/CD-74/200) Avail: NTIS HC $10.00 CSCL 13B

Constraints to water resource development are analyzed along with historical resource development, water availability above present uses, cost of delivery in Wyoming, Montana, and North Dakota. A separate report is included on in-stream needs. It

projects amounts of water that should be left in streams to maintain present riparian and aquatic habitats. It assumes that there is a need for maintaining fluctuatin; annual flows rather than traditional minimum level flows. A separate report is included on the wild and scenic river recreational values of Upper Missouri and Yellowstone Basin streams that may be affected by coal development. GRA

N76-13545*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
ON MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, 1974 - 1975
James L. Clapp, Principal Investigator 1975 154 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-50-002-127)
(E76-10058; NASA-CR-145750) Avail: NTIS HC $6.75 CSCL 08H

N76-13547*# Sheffield Univ. (England). Dept. of Geography.
DRAINAGE NETWORK ANALYSIS USING SKYLAB IMAGERY, AERIAL PHOTOGRAPHS AND MAPS: A CASE STUDY FROM SE SPAIN
J. L. VanGenderen, Principal Investigator, J. Evans, and D. Webb Oct. 1975 11 p refs Sponsored by NASA EREP
(E76-00060; NASA-CR-145752) Avail: NTIS HC $3.50 CSCL 08B

N76-13553*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY Progress Report, 1 Jan. - 31 Mar. 1975
R. K. Jain, Principal Investigator 4 Jun. 1975 3 p ERTS
(E76-10066; NASA-CR-145758) Avail: NTIS HC $3.50 CSCL 13B

N76-13561*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF LAKE EUTROPHICATION IN THE GREAT LAKES BASIN Progress Report, 11 Aug. - 11 Nov. 1975
Robert H. Rogers, Principal Investigator Nov. 1975 55 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20942)
(E76-10074; NASA-CR-145699; BSR-4208) Avail: NTIS HC $4.50 CSCL 08H

The author has identified the following significant results. Computer techniques developed for mapping water quality parameters from LANDSAT data were demonstrated, using ground truth collected in an ongoing survey of water quality in Saginaw Bay (Lake Huron), Michigan. Regression correlation coefficients varied from 0.99 for total phosphorus to 0.72 for chlorophyll-a corrected. Five water quality parameters are best correlated with LANDSAT band 6 alone. Temperature relates to band 5 alone and only two bands are justified for mapping the remaining six parameters. LANDSAT CCTs were used as a basis for inventorying land use within each of the Ohio-Kentucky-Indiana regional commissions, 225 drainage areas, and nine counties. Sixteen categories were merged into ten categories and mapped at a scale of 1 in. = 5,000 ft, with detail to 0.44 hectares for the 2,700 sq mi region. These products were produced in less than 90 days at a cost of one cent an acre. LANDSAT CCTS were also used as a basis for inventorying land cover within the Triangle J council of governments 1,750 sq mi study area. The complete inventory was accomplished within a period of 60 days at a cost of about one half cent per acre.

N76-14564*# Calspan Corp., Buffalo, N.Y.
S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Final Report
Kenneth R. Piech, Principal Investigator, John R. Schott, and Kenton M. Stewart (States Univ. of N. Y., Buffalo) Jun. 1975 50 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13336)
(E76-10081; NASA-CR-144499; YB-5298-M-2) Avail: NTIS HC $4.00 CSCL 08H

The author has identified the following significant results. The program has demonstrated that Skylab imagery can be utilized to regularly monitor eutrophication indices of lakes, such as chlorophyll concentration and photic zone depth. The relationship between the blue to green reflectance ratio and chlorophyll concentration was shown, along with changes in lake properties caused by chlorophyll, lignin, and humic acid using reflectance ratios and changes. A data processing technique was developed for detecting atmospheric fluctuations occurring over a large lake.

N76-14570* Minnesota Univ., Minneapolis. Dept. of Geography.
REMOTE SENSING APPLICATIONS TO HYDROLOGY IN MINNESOTA
Dwight Brown and Richard Skaggs *In its* A Study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 66 p refs

CSCL 08H

Development of low lying southeastern shore of Pike Lake is described as part of the Rice Creek watershed study. Several small wetlands in Arden Hills, Minnesota were incorporated into the drainage plans as pollutant and nutrient sinks rather than being infilled. Lake water quality in the St. Paul-Minneapolis metropolitan area was analyzed using Landsat images. In the same urban area, the inventory and seasonal change of the open water were also studied. J.A.M.

N76-14571* Minnesota Univ., Duluth. Dept. of Physics.
TURBIDITY IN EXTREME WESTERN LAKE SUPERIOR
Michael Sydor *In its* A Study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 25 p refs
CSCL 08H

Data were obtained from ERTS images for western Lake Superior for 1972-74. Data examination showed that for easterly winds the turbidity originating along the Wisconsin shore and the resuspension areas are transported northward then out along a N.E. path where it disperses, and often, for large storms, contaminates the Duluth water intake. Contaminants such as dredging fines anywhere along these paths would likewise find their way to the intake areas in concentrations comparable to the relative red clay concentration. J.A.M.

N76-14576*# Ecosystems International, Inc., Gambrills, Md.
THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS
Peter A. Castruccio, Harry L. Loats, Jr., Thomas R. Fowler, and Susan L. Frech 7 Jan. 1975 27 p refs
(Contract NAS8-30539)
(NASA-CR-144078; ECO-75-C-2-1) Avail: NTIS HC $4.00 CSCL 08H

Regional hydrologic planning models built upon remote sensing capabilities and suited for ungaged watersheds are developed. The effectiveness of such models is determined along with which parameters impact most the minimization of errors associated with the prediction of peak flow events (floods). Emphasis is placed on peak flood prediction because of its significance to users for the purpose of planning, sizing, and designing waterworks. J.M.S.

N76-14577*# Ecosystems International, Inc., Gambrills, Md.
THE APPLICATION OF REMOTE SENSING TO THE

DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS Final Report
Peter A. Castruccio, Harry L. Loats, Jr., Thomas R. Fowler, and Susan L. Frech 7 Jan. 1975 196 p refs
(Contract NAS8-30539)
(NASA-CR-144079; ECO-75-C-2-1-F) Avail: NTIS HC $7.50 CSCL 08H
For abstract, see N76-14576.

N76-15526*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATIONS OF REMOTE SENSING TO ESTUARINE PROBLEMS Annual Report
John C. Munday, Jr. Dec. 1975 178 p refs
(Grant NGL-47-022-005)
(NASA-CR-146075; AR-3) Avail: NTIS HC $7.50 CSCL 08J
A variety of siting problems for the estuaries of the lower Chesapeake Bay have been solved with cost beneficial remote sensing techniques. Principal techniques used were repetitive 1:30,000 color photography of dye emitting buoys to map circulation patterns, and investigation of water color boundaries via color and color infrared imagery to scales of 1:120,000. Problems solved included sewage outfall siting, shoreline preservation and enhancement, oil pollution risk assessment, and protection of shellfish beds from dredge operations. Author

N76-15563# Arizona Univ., Tucson. School of Renewable Natural Resources.
DEVELOPMENT OF A BIBLIOGRAPHIC INFORMATION SYSTEM FOR WATER YIELD IMPROVEMENT PRACTICES Project Completion Report, Jul. 1972 - Jun. 1975
Linda M. White, David B. Thorud, and Peter F. Ffolliott Aug. 1975 11 p refs
(Contract DI-14-31-0001-3803)
(PB-244699/1; W75-11050) Avail: NTIS HC $3.50 CSCL 13B
Development of the Watershed Management Information System (WAMIS) began in 1972. WAMIS is designed to serve a variety of users who are interested in water and natural resource research in Arizona. WAMIS is a computerized bibliographic reference retrieval system which provides literature searches for users, in the form of individualized computer printouts of citations and abstracts, based upon a user's special interests. The literature covered in WAMIS includes effects of land management practices and vegetation management on water and other related resources, such as forage production, wildlife habitat, timber production, and recreational use. Research done in Arizona was emphasized. General procedures used in banking and retrieval are described. Types of search requests have varied, including topics such as wildlife use of ponderosa pine forests, environmental and vegetation effects on evapotranspiration, hydrologic modeling, Arizona water quality data, the effect of timber cutting practices on runoff, and revegetation of treated pinyon-juniper vegetation. GRA

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07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A76-10514 **Aircraft against sea pollution (L'avion contre la pollution marine).** Y. Lerendu (Centre de Documentation de l'Armement, Paris, France). *L'Aéronautique et l'Astronautique,* no. 52, 1975, p. 37-47. 27 refs. In French.

A system is described which permits aircraft identification of the sources of oil spills on the basis of analyses of the physical and chemical characteristics of the supernatant hydrocarbon layers. Methods of analyzing the infrared, visible, and Hertzian radiation of polluted and nonpolluted areas of the ocean are discussed. The use of electromagnetic excitation by radar and laser techniques in identification of physical and chemical properties of oil spills is described, with attention to fluorescence and the Brillouin and Raman effects. Flow charts for operational aspects of oil spill detection and identification are given. C.K.D.

A76-11104 * **The Rome-GSFC magnetic field experiment for Helios A and B /E 3/.** C. Scearce, N. Ness, L. Burlaga (NASA, Goddard Space Flight Center, Greenbelt, Md.), S. Cantarano, R. Terenzi (CNR, Laboratorio per il Plasma nello Spazio, Frascati, Italy), and F. Mariani (L'Aquila, Università, L'Aquila, Italy). *Raumfahrtforschung,* vol. 19, Sept.-Oct. 1975, p. 237-240.

The Rome-GSFC magnetic field experiment utilizes a triaxial fluxgate (saturable inductor) magnetometer. The sensor unit is mounted on the end of a boom approximately four meters from the spacecraft spin axis. The three analog outputs of the magnetometer are converted into three 9 bit digital words. The experiment utilizes an automatic inflight range switch to select the optimum dynamic range out of 4 ranges. A nonmagnetic thermally oscillating actuator is used to reorient the sensor unit by 90 deg to determine all three axes zero levels. The accuracy should be approximately plus or minus 0.1 gamma. The vector measurements are made at equal intervals in time ranging from 16 per second down to 1 per second depending on the telemetry bit rate. (Author)

A76-11298 * # **Temporal registration of multispectral digital satellite images using their edge images.** M. L. Nack (Computer Sciences Corp., Silver Spring, Md.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Astrodynamics Specialist Conference, Nassau, Bahamas, July 28-30, 1975, AAS Paper 75-104.* 73 p. 11 refs. Contract No. NAS5-11999.

An algorithm is described which will form an edge image by detecting the edges of features in a particular spectral band of a digital satellite image. It is capable also of forming composite multispectral edge images. In addition, an edge image correlation algorithm is presented which performs rapid automatic registration of the edge images and, consequently, the grey level images. V.P.

A76-11677 # **Combined digital and analog evaluation techniques under operational aspects.** J. Bodechtel and R. Haydn (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 35, 37-49. 6 refs.

The paper discusses the general principles of automatic classification of spectral data obtained by earth resource satellites and examines the advantages gained by special preprocessing techniques for either fully automatic interpretation or for combined analog/digital interactive processing. These preprocessing techniques are (1) enhancement of class separability by weighted linear component transformation, (2) color coding by operating in three-dimensional color space, and (3) decision making by analyzing and separating color distributions. P.T.H.

A76-11685 # **New instrument concept for earth resources survey.** A. Peraldi (Engins MATRA, S.A., Vélizy-Villacoublay, Yvelines, France). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 209, 211-217.

A multispectral scanner for earth resources survey has been designed. It features 9 spectral bands in visible and near infrared and onboard preprocessing of the spectral data. Conical scan is performed in the image plane of a modified Bouwers-Maksutov catadioptric telescope. Spectral selection is performed by a grating monochromator; the diffracted image of the instantaneous field of view is transferred to 9 rows of silicon photo-diodes by fiber optics. (Author)

A76-11691 # **Remote measurements of the thermal pollution of rivers.** D. Lorenz (Deutscher Wetterdienst, Agrarmeteorologische Forschungsstelle, Bonn, West Germany). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 283, 285-293. *Research sponsored by the Bundesministerium des Innern.*

The thermal pollution of the Saar and Rhine rivers was investigated by airborne infrared line scanners (IRLS) and infrared radiation thermometers (IRT). The IRLS images were useful for making visible warm and hot outlets and the mixing process with the river water in the vicinity of the outlet. IRT flights, however, were necessary for receiving satisfactory quantitative results. The sensitivity and the accuracy of IRLS equipment is not sufficient for that up to now. At the Saar a heating across the whole width of more than 10 deg C within a distance of less than 40 km was found. It was mainly caused by big power plants. Due to its higher discharge rate, the warming of the Rhine river was much less. Strongly marked plumes of warm water were observed there. (Author)

A76-11805 # **Relationship between coordinates of terrain points and the coordinates of image points for side-looking radars with an antenna directed along the fuselage (Sootnoshenie koordinat tochek mestnosti i koordinat tochek izobrazheniia v radiolokatsionnykh stantsiiakh bokovogo obzora s vdol'fiuzeliazhnoi antennoi).** I. G. Zhurkin and Iu. N. Korneev (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka,* no. 6, 1974, p. 43-52. 5 refs. In Russian.

The geometry of radar images is analyzed, and a block diagram of a typical airborne side-looking radar with an antenna running along the fuselage is discussed. Formulas describing the relationship between the coordinates of points of the terrain and the corresponding coordinates of the radar image are derived. V.P.

A76-12003 # **Study of the condition of continental covers and water areas by microwave-radiometric methods (Issledovanie sostoianiia materikovykh pokrovov i akvatorii metodami SVCh radiometrii).** A. E. Basharinov, L. F. Borodin, A. S. Gurvich, M. S. Malkevich, and A. M. Shutko. *Uspekhi Fizicheskikh Nauk,* vol. 116, Aug. 1975, p. 743-746. 13 refs. In Russian.

Factors that determine the intensity and polarization of thermal radio emission from terrestrial land and ocean surfaces are briefly outlined. Some results of measurements of this emission by satellites and aircraft are presented. It is shown that: (1) the intensity and polarization of emission from land surfaces depend on the effective temperature and degree of blackness of the emitting object, (2) emission from water areas originates in a thin surface layer, (3) the intensity and polarization of emission from water surfaces depends on temperature, the salt content of the water, the intensity of sea swells, white caps and oil slicks on the surface, and the presence of ice fields. F.G.M.

A76-12017 # **Dynamic methods of satellite geodesy (Dinamicheskie metody sputnikovoi geodezii).** S. K. Tatevian. In: Publication of scientific results of the INTERCOSMOS collaboration. Moscow, Astronomicheskii Sovet Akademii Nauk SSSR, 1974, p. 184-189. 17 refs. In Russian.

The dynamic methods reviewed permit accurate determination of the geocentric coordinates of satellite tracking stations regardless of the distance between the stations, provided the exact geocentric position of the orbiting satellite is known. Particular attention is given to the orbital method proposed by Veis and to Minkowski's algorithm for applying this method to the calculation of the geocentric coordinates of stations. C.K.D.

A76-12026 Scientific results of the INTERCOSMOS collaboration; Conference on Scientific Research by Artificial Satellites Observations, Budapest, Hungary, October 21-24, 1974, Transactions (Rezultatele stiintifice ale cooperarii 'INTERCOSMOS'; Conferinta asupra Cercetarilor Stuntifice cu Ajutorul Observatiilor Satelitilor Artificiali, Budapest, Hungary, October 21-24, 1974, Publicatii). Edited by A. Dinescu. Bucharest, Editura Academiei Republicii Socialiste Romania (Observatii ale Satelitilor Artificiali ai Pamintului, No. 14), 1975. 644 p. In Russian, English, and German.

Papers are presented in which numerous data regarding satellite positions are given and analyzed for their application in satellite dynamics studies, geodesy, upper atmosphere investigations. New observational and computational techniques for satellite position and orbit determination are described. Some of the topics covered include geodetic uses of resonances of the 15th order in the motion of satellites, numerical and analytical methods for the solution of surface integrals connected with the simple layer model of the geopotential, global satellite triangulation and trilateration results, satellite connections of continental geodetic networks by means of an ellipsoidal method, total intensity of the density changes in the upper atmosphere during a geomagnetic storm, and the use of quasi-synchronous observations of satellites. P.T.H.

A76-12341 # **Optimal transformation of information into digital form while measuring ocean surface temperature from a satellite (Optimal'noe preobrazovanie informatsii v tsifrovuiu formu pri izmerenii temperatury poverkhnosti okeana so sputnika).** Iu. A. Khudiakov. *Morskie Gidrofizicheskie Issledovaniia,* no. 4, 1974, p. 175-182. 5 refs. In Russian.

Optimal values are determined for the intervals of discretization over space and the level of the measured horizontal section of the temperature field which provide the prescribed accuracy of a reconstruction carried out with minimal data volume transmitted through the communication channel. The error caused by averaging the field over space using a radiometer is investigated. (Author)

A76-12623 # **Convergence of an iteration method for adjusting indirect observations (Za skhodimostta na edin iteratsionen metod pri izravnenie na posredstveni nabliudeniia).** Ts. Gergov (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Vissha Geodeziia, Sofia, Bulgaria). *Vyssha Geodeziia,* no. 1, 1975, p. 60-65. In Bulgarian.

The iteration method for adjustment of triangulation networks proposed by Mashimov (1965) is generalized. Comparison with Seidel's group iteration method for solving a normal system establishes the convergence of the method. Advantages and disadvantages of Mashimov's method for adjustment of an arbitrary geodetic construction are discussed. P.T.H.

A76-12645 # **Comparison of sea-ice type identification between airborne dual-frequency passive microwave radiometry and standard laser/infrared techniques.** S. G. Tooma, R. D. Ketchum, Jr. (U.S. Naval Oceanographic Office, Washington, D.C.), R. A. Mennella, and J. P. Hollinger (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 225-238; Discussion, p. 23β, 239. 8 refs.

A76-12646 # **Temperature measurement of ice and water surfaces in the North Water area using an airborne radiation thermometer.** F. Müller, H. Blatter, and G. Kappenberger (Eidgenössische Technische Hochschule, Zurich, Switzerland; McGill University, Montreal, Canada). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 241-250; Discussion, p. 250. 6 refs. Department of Supply and Services of Canada Contract No. OSX4-0098; Swiss National Science Foundation Grant No. 2,383,70; NSF Grant No. CV-40404A1.

Ice and water surface temperatures were measured with an airborne radiation thermometer PRT-5 over the North Water polynya during three missions between late winter and early summer 1974. Error corrections, problems of data analyses and mapping are discussed. Attempts are made to relate the main types of sea ice to temperature ranges, which then are used in conjunction with satellite pictures to produce surface temperature maps. (Author)

A76-12651 # **Characterization of cold-regions terrain using airborne laser profilometry.** W. D. Hibler, III (U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 329-346; Discussion, p. 346, 347. 25 refs. ARPA Order 1615.

This paper provides a review of the characteristics of airborne laser profilometry and its application to quantitative characterization of cold-regions terrain. The limitations of profilometry due to the profiler instrumental characteristics and instability of the aircraft platform are discussed. Digital filtering and hardware techniques for removing the aircraft motion, and hence extending the long wavelength validity of the profile, are discussed. Ridge height and spacing distribution models for sea ice in conjunction with digitally processed laser profiles allow efficient characterization of sea-ice ridging using only a few parameters. In particular, a single ridging intensity parameter has been found to allow reasonable estimation of the number of ridges encountered at any height level along a straight-line path. Examination of spectral characteristics of first-year and multi-year ice suggest that laser profiles may be used to identify the ice type of floes and ridges. (Author)

A76-12652 * # **Satellites - New global observing techniques for ice and snow.** P. Gloersen and V. V. Salomonson (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, Md.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 373-387; Discussion, p. 387-389. 13 refs.

The possibility that the variation in areal extent of the snow cover may be related by empirical means to the average monthly run-off in a given watershed was demonstrated by comparing run-off records from the Indus River Basin in south-east Asia with a series of snow-cover maps obtained from Nimbus-3 and 4 imagery. Similar

studies using the higher spatial resolution available with ERTS-1 imagery were carried out for the Wind River Mountains watersheds in Wyoming, where it was found that the empirical relationship varied with mean elevation of the watershed. In addition, digital image enhancement techniques are shown to be useful for identifying glacier features thought to be related to extent of snow cover, moraine characteristics, debris coverage, and the like. Finally, longer wavelength observations using sensors on board the Nimbus-5 satellite are shown to be useful for indicating crystal size distributions and onset of melting on glacier snow cover. (Author)

A76-13367 **Airborne electromagnetic surveys - Their contribution to the discovery of natural earth resources (Les levées aéroélectromagnétiques - Leur contribution à la découverte de richesses naturelles mondiales).** M. K. Seguin (Université Laval, Quebec, Canada). *L'Onde Electrique,* vol. 55, Jan. 1975, p. 38-47. 69 refs. In French.

The paper outlines the development of electromagnetic (EM) prospecting techniques, characterizes the principal phases of an EM operation carried out by helicopter or airplane, and discusses the main considerations in data interpretation. Two different techniques are investigated: EM surveying at two emission frequencies and in phase quadrature, and inducted pulse transient (INPUT) EM surveying. An example of data interpretation for the INPUT airborne EM technique is given. P.T.H.

A76-13548 # **Multispectral scanning systems and their potential application to earth-resources surveys. I - Basic physics and sensing technology.** A. D. Higham, P. B. Wilkinson, D. A. Kahn, E. Fitzgerald, Q. S. Earl, and G. Taylor (Plessey Radar, Ltd., Havant, Hants. and Stoke Poges, Bucks., England). *ESA Scientific and Technical Review,* vol. 1, no. 2, 1975, p. 85-118. 37 refs.

A summary is given of the various processes affecting the interaction of radiation and matter that give rise to useful information about the surface of the earth. The methods of sensing this information are reviewed along with the properties of specific materials of interest, the processing of the data acquired by a multispectral-scanning system, and the applications to which such a system may be directed. (Author)

A76-13549 # **Multispectral Scanning Systems and their potential application to earth-resources surveys. II - Earth-science applications.** R. A. G. Savigear, E. H. Roberts (Reading, University, Reading, Berks., England), D. A. Huntley (Institute of Coastal Oceanography and Tides, Bidston, Ches., England), J. S. G. McCullock, R. B. Painter (Institute of Hydrology, Wallingford, Berks., England), J. W. Norman (Imperial College of Science and Technology, London, England), D. Bannert, P. H. T. Beckett, D. P. Bickmore, and E. Cripps. *ESA Scientific and Technical Review,* vol. 1, no. 2, 1975, p. 119-161. 323 refs.

The characteristics and potential uses of Multispectral Scanning Systems are reviewed and it is proposed that a multidisciplinary and integrated regional approach to evaluation and development should be followed. Their applications in agriculture and forestry, geology, hydrology and oceanography are considered as illustration of our current understanding of their advantages and limitations. Illustrations are also given of typical experimental programmes. The conclusions discuss developments appropriate for a European programme and insist on the importance of financing the establishment of properly instrumented test sites and areas representative of regional conditions and problems. (Author)

A76-14447 **Ocean wave cross-radial image error in synthetic aperture radar due to radial velocity.** K. Tomiyasu (GE Valley Forge Space Center, Philadelphia, Pa.). *Journal of Geophysical Research,* vol. 80, Nov. 20, 1975, p. 4555. 6 refs.

A76-15766 # **Studies in radio-frequency radiometry for remote sea ice thickness measurement.** J. D. Robar, H. C. Wood, and A. Kavadas (SED Systems, Ltd., Canada). *Canadian Journal of Remote Sensing,* vol. 1, Nov. 1975, p. 73-75. Research supported by the Ministry of Transport, Transportation Development Agency, and Air Administration.

A theoretical evaluation of the use of UHF radiometry for the remote measurement of sea ice thickness has been completed. The theoretical study firstly determined the emissive properties of sea ice at UHF and determined which physical properties of the ice are most readily examined by radiometers. Secondly, the study determined the optimum instrumentation for air-borne sensing. (Author)

A76-15770 # **Latest developments with an air-borne gas filter correlation spectrometer.** J. H. Davies, T. V. Ward, and H. H. Zwick (Toronto, University, Toronto, Canada). *(Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Canada, Feb. 4, 5, 1975.) Canadian Journal of Remote Sensing,* vol. 1, Nov. 1975, p. 103-113. 6 refs.

The operation and design of the gas filter correlation spectrometer (GASPEC), which can be used as an airborne or upward-looking device for the remote sensing of trace gases, is discussed. A sample of the target gas acts as a highly selective filter for incoming radiation. The radiance transmitted through the sample cell is compared with that transmitted by a reference cell containing a spectrally inactive gas to provide an indicator of the amount of target gas signature in the incoming radiation. Two detectors receive amplitude-shared signals at the source-chopping frequency. A common field stop and chopper provide simultaneous sampling of the source radiance through both sensor arms. Radiance from two internal black bodies with different low temperatures are alternately chopped to generate a constant reference signal. A third adjustable reference, black body is incorporated. Experimental data from laboratory and field tests of GASPEC units capable of monitoring carbon monoxide, methane, ethane, and hydrogen chloride are presented. C.K.D.

A76-15968 **Variable width rectangular slit jet impactor.** A. C. Delany and G. J. Dolan (National Center for Atmospheric Research, Boulder, Colo.). *Review of Scientific Instruments,* vol. 46, Dec. 1975, p. 1650-1652. 7 refs.

A rectangular slit jet impactor has been designed and fabricated for use as an airborne collector of supergiant aerosol particles. The width of the slit is variable, allowing the impactor size cutoff to be set so that only particles greater than a determined size are collected. The jet convergence angle was made to be 53 deg 13 min to ensure that the width of the slit is always the same as the distance from jet mouth to the impaction substrate. Experimental calibration of the impactor indicates that this configuration gives excellent impaction characteristics. (Author)

A76-16200 **Conference on Machine Processing of Remotely Sensed Data, 2nd, Purdue University, West Lafayette, Ind., June 3-5, 1975, Proceedings.** Conference sponsored by the Institute of Electrical and Electronics Engineers. Edited by C. D. McGillem (Purdue University, West Lafayette, Ind.). *IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976. 78 p.

The papers deal with methods for analyzing and using remotely sensed data as well as with current research on machine processing of such data. Topics include the technological basis and applications of remote sensing of the earth's resources, pattern recognition in remote-sensing problems, the classification of digitized multispectral-image data, canonical analysis for increased classification speed and channel selection, a signature-extension method for use with LANDSAT data, line detection in satellite imagery, image-registration error variance as a measure of overlay quality, a machine-aided multispectral analysis using Skylab thermal data for land-use mapping, the processing of remotely sensed data for dimensional analysis, remote sensing as a means of determining ground-water inflow to lakes, and the photographic display of

LANDSAT-1 computer-compatible-tape images for improved geological definition.

F.G.M.

A76-16201 Technological basis and applications of remote sensing of the earth's resources. M. E. Bauer (Purdue University, West Lafayette, Ind.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 3-9. 34 refs.

Remote sensing provides an unmatched data source for obtaining information about earth resources. This paper briefly describes the development of remote sensing, then discusses the physical and technological bases for obtaining earth-resources information from airborne and spaceborne sensors. It is noted that information may be derived by analyzing the spectral, spatial, and temporal variations of energy emanating from the earth's surface. The two types of analysis, image-oriented and numerical-oriented, are discussed with emphasis on the latter and on machine-processing of data. Finally, applications of remote-sensing technology are discussed. (Author)

A76-16205 Signature extension using the MASC algorithm. R. G. Henderson. *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 34-37. 6 refs.

A signature-extension method for use with LANDSAT data has been developed. The MASC (Multiplicative and Additive Signature Correction) algorithm uses an unsupervised clustering routine to gain relative information from two data sets. This information is then used to map the signatures derived from one data set onto the other data set. The MASC algorithm can be totally automated, thus making it suitable for use in large-area crop inventories. This signature-extension method has been tested on agricultural LANDSAT data. Results of field-center pixel classification using MASC-extended signatures have been compared with classification results using untransformed signatures. In all three data set pairs, the MASC algorithm yielded very good results. (Author)

A76-16206 Line detection in satellite imagery. G. J. Vanderbrug (Maryland, University, College Park, Md.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 37-44. 9 refs. NSF Grant No. GJ-32258X.

Three line-detection algorithms for use in satellite imagery are examined (the linear detector, the nonlinear detector, and the semilinear detector) to form the basis for a project on computer recognition of geologically interesting linear features. Experiments are described which were conducted to evaluate the detection of linear features in terrain on LANDSAT-1 images and the detection of suburban roads on Skylab images. It is shown that the semilinear detector is slightly superior to the linear one and also has the advantage of not responding to edges. It is noted, however, that the semilinear detector responds to considerably more background noise than the nonlinear detector, while the latter usually works quite well with low thresholds. F.G.M.

A76-16207 * Image registration error variance as a measure of overlay quality. C. D. McGillem and M. Svedlow (Purdue University, West Lafayette, Ind.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 44-49. Grant No. NGL-15-005-112; Contract No. NAS9-14016.

When one image (the signal) is to be registered with a second image (the signal plus noise) of the same scene, one would like to know the accuracy possible for this registration. This paper derives an estimate of the variance of the registration error that can be expected via two approaches. The solution in each instance is found to be a function of the effective bandwidth of the signal and the noise, and the signal-to-noise ratio. Application of these results to LANDSAT-1 data indicates that for most cases, registration variances will be significantly less than the diameter of one picture element. (Author)

A76-16209 Processing remotely sensed data for dimensional analysis. T. L. Cox (South Dakota State University, Brookings, S. Dak.), H. C. Hitchcock, and S. G. Weber (Tennessee Valley Authority, Div. of Forestry, Fisheries, and Wildlife Development, Norris, Tenn.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 55-59. 5 refs. NSF-AEC-sponsored research.

Forest-inventory data were interpreted from color IR photography, transferred to base maps, and digitized for machine processing. The data were registered to geodetic coordinates, providing the capability of performing several types of dimensional analysis. Processing data by this technique allowed: (1) spatial or single-variable analysis, (2) overlay or composite analysis (in combination with other variables), and (3) temporal analysis. Information derived from this procedure was employed as input for a land-management decision system used to construct a forest-management plan for 25,000 acres in east Tennessee. (Author)

A76-16292 * Spectral signature selection for mapping unvegetated soils. G. A. May and G. W. Petersen (Pennsylvania State University, University Park, Pa.). *Remote Sensing of Environment,* vol. 4, no. 3, 1975, p. 211-220. 12 refs. Contract No. NAS5-23133.

Airborne multispectral scanner data covering the wavelength interval from 0.40-2.60 microns were collected at an altitude of 1000 m above the terrain in southeastern Pennsylvania. Uniform training areas were selected within three sites from this flightline. Soil samples were collected from each site and a procedure developed to allow assignment of scan line and element number from the multispectral scanner data to each sampling location. These soil samples were analyzed on a spectrophotometer and laboratory spectral signatures were derived. After correcting for solar radiation and atmospheric attenuation, the laboratory signatures were compared to the spectral signatures derived from these same soils using multispectral scanner data. Both signatures were used in supervised and unsupervised classification routines. Computer-generated maps using the laboratory and multispectral scanner derived signatures resulted in maps that were similar to maps resulting from field surveys. Approximately 90% agreement was obtained between classification maps produced using multispectral scanner derived signatures and laboratory derived signatures. (Author)

A76-16293 Chromaticity changes from isoluminous techniques used to enhance multispectral remote sensing data. J. C. Munday, Jr. (Erindale College, Clarkson, Ontario, Canada) and T. T. Alfoldi (Canada Centre for Remote Sensing, Ottawa, Canada). *Remote Sensing of Environment,* vol. 4, no. 3, 1975, p. 221-236. 13 refs.

Isoluminous transformations are useful for enhancing small color differences in displays of multispectral photographic data, and for removing unwanted total radiance variations in multispectral scanner data. Several three-band isoluminous transformations were investigated mathematically to determine if they cause confusing color changes. The photographic technique of Yost and Wenderoth (1967, 1970, 1974), nonlinear in single-band functions, is shown to be strictly isoluminous only for grey shades; departure from isoluminosity is negligible for nonsaturated colors; the transformation causes an increase in chromatic saturation. A new transformation, linear in single-band functions, which is strictly isoluminous, can cause

chromatic confusion unless original brightness variations are small. Another new transformation, linear in three-band functions, is also strictly isoluminous, but causes chromatic confusion. Its non-linear counterpart, ratio normalization, is found to be theoretically optimal because it is strictly isoluminous and chromaticity invariant.
(Author)

A76-17361 # **Processing of imagery (Traitement des données images).** M. Traizet (ESA, METEOSAT Programme Office, Toulouse, France). *Association Aéronautique et Astronautique de France, Symposium Spatial Européen, 14th, Toulouse, France, Apr. 23-25, 1975, Paper.* 14 p. In French.

The paper describes the main steps in the processing of imagery transmitted from the geostationary satellite METEOSAT, which will obtain images of the terrestrial cloud cover. These steps include correction and setting out of the images (geographic localization of image points, restitution of radiances, alignment of spectral channels, and image quality control) and extraction of meteorological parameters, which will be achieved through both an automatic system and an interactive manual system. Basic parameters extracted will include cloud cover (density of clouds at various altitudes, temperature at upper cloud layer), sea surface temperature, height of cloud tops, and wind fields. Some brief data are given on the computer support to be used. P.T.H.

A76-17712 **Use of a laser resonator for raising the sensitivity of laser-type aerosol spectrometers.** Iu. V. Zhulanov, B. F. Sadovskii, and I. V. Petrianov (Nauchno-Issledovatel'skii Fiziko-Khimicheskii Institut, Moscow, USSR). *(Akademiia Nauk SSSR, Doklady,* vol. 222, June 1, 1975, p. 810-812.) *Soviet Physics - Doklady,* vol. 20, no. 6, 1975, p. 437, 438. Translation.

A76-17776 # **Use of laser radar in atmospheric studies /Review/ (Ispol'zovanie lazernoi lokatsii v issledovaniiakh atmosfery /Obzor/).** O. K. Kostko (Tsentral'naia Aerologicheskaia Observatoriia, Dolgoprudny, USSR). *Kvantovaia Elektronika* (Moscow), vol. 2, Oct. 1975, p. 2133-2162. 211 refs. In Russian.

Results are presented on the experimental investigations of the atmosphere with the aid of lidars. The discussion covers the use of various types of laser emission scattering in the atmosphere for determining the standard meteorological parameters, composition, and pollution level of the atmosphere. Data are provided on laser probing of tropospheric, stratospheric, and mesospheric clouds as well as of cosmic dust. The possibility of using lidars aboard meteorological satellites is discussed. S.D.

A76-17913 * **ATS-6 - UCLA fluxgate magnetometer.** R. L. McPherron, P. J. Coleman, Jr., and R. C. Snare (California, University, Los Angeles, Calif.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-11, Nov. 1975, p. 1110-1117. 12 refs. Contract No. NAS5-11674.

A summary of the design of the University of California at Los Angeles' fluxgate magnetometer is presented. Instrument noise in the bandwidth 0.001 to 1.0 Hz is of order 85 m gamma. The DC field of the spacecraft transverse to the earth-pointing axis is 1.0 + or - 21 gamma in the X direction and -2.4 + or - 1.3 gamma in the Y direction. The spacecraft field parallel to this axis is less than 5 gamma. The small spacecraft field has made possible studies of the macroscopic field not previously possible at synchronous orbit. At the 96 W longitude of Applications Technology Satellite-6 (ATS-6), the earth's field is typically inclined 30 deg to the dipole axis at local noon. Most perturbations of the field are due to substorms. These consist of a rotation in the meridian to a more radial field followed by a subsequent rotation back. The rotation back is normally accompanied by transient variations in the azimuthal field. The exact timing of these perturbations is a function of satellite location and the details of substorm development. (Author)

A76-17945 **Location estimation and guidance using radar imagery.** J. A. Cooper and L. T. James (Sandia Laboratories, Albuquerque, N. Mex.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-11, Nov. 1975, p. 1383-1388. 12 refs. ERDA-supported research.

Radar map-matching location-estimation systems compare radar images of the terrain with a memory 'map' to obtain an estimate of sensor position in the mapped area for guidance. This correspondence summarizes a data-acquisition program involving an omnidirectional range-scan radar sensor, and presents results of theoretical guidance exercises based on comparing actual radar signals with computer-generated memories. (Author)

A76-18503 * # **Great Lakes all-weather ice information system.** R. J. Schertler, R. A. Mueller, R. J. Jirberg, D. W. Cooper, J. E. Heighway, A. D. Holmes, R. T. Gedney, and H. Mark (NASA, Lewis Research Center, Cleveland, Ohio). *Environmental Research Institute of Michigan, International Symposium on Remote Sensing of the Environment, 10th, Ann Arbor, Mich., Oct. 6-10, 1975, Paper.* 29 p. 10 refs.

The all-weather ice information system described uses the X-band side-looking airborne radar to determine the aerial distribution, location, and type of ice cover in the Great Lakes and an airborne S-band short-pulse radar to determine the ice thickness. Results from the 1974-1975 winter season demonstrated the ability of the system to provide all-weather ice information to shippers at the required time. V.P.

A76-18550 **The preprocessing of multispectral data. I (Zur Vorverarbeitung multispektraler Daten. I).** F. Quiel (Karlsruhe, Universität, Karlsruhe, West Germany). *Bildmessung und Luftbildwesen,* vol. 44, Jan. 1, 1976, p. 42-44. In German.

Automatic procedures for the classification of multispectral scanning data are considered. In many cases a great amount of information concerning the terrain is required for a determination of the spectral features which are typical for a certain class. A classification in the absence of such information is difficult. The difficulties are partly related to seasonal and diurnal changes in solar radiation. Approaches are discussed to obtain characteristic data which are independent of the total light intensity. These approaches, in the form of a number of preprocessing algorithms, make use of an analysis of the brightness and color characteristics of the obtained data. Difficulties concerning an application of the new methods are related to effects of the atmosphere on the signal which is emitted by the terrestrial surface. G.R.

N76-10534*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
CANONICAL ANALYSIS AND TRANSFORMATION OF SKYLAB MULTISPECTRAL SCANNER DATA Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, D. M. Barr, and B. F. Merembeck Aug. 1975 6 p refs EREP
(Contract NAS9-13406)
(E76-10002; NASA-CR-119109; ORSER-SSEL-TR-18-75) Avail: NTIS HC $3.25 CSCL 08L

The author has identified the following significant results. The original transformation matrix, C, had sixteen axes. However, the first three axes contained 98.83% of the variance contained within the transformation. The values for axes one, two, and three were 83.61%, 14.49%, and 0.72%, respectively. The result was an 81.25% reduction in data bulk. It is expected that using transformed data for classification will result in significant reductions in computer cost.

N76-10549*# Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
REMOTE SENSOR DIGITAL IMAGE DATA ANALYSIS

USING THE GENERAL ELECTRIC IMAGE 100 ANALYSIS SYSTEM (A STUDY OF ANALYSIS SPEED, COST, AND PERFORMANCE) Interim Report
George J. McMurtry and Gary W. Petersen, Principal Investigators
Aug. 1975 41 p refs ERTS
(Contract NAS5-23133)
(E76-10017; NASA-CR-119125; ORSER-SSEL-TR-15-75) Avail: NTIS HC $3.75 CSCL 05B

The author has identified the following significant results. It was found that the high speed man machine interaction capability is a distinct advantage of the image 100; however, the small size of the digital computer in the system is a definite limitation. The system can be highly useful in an analysis mode in which it complements a large general purpose computer. The image 100 was found to be extremely valuable in the analysis of aircraft MSS data where the spatial resolution begins to approach photographic quality and the analyst can exercise interpretation judgements and readily interact with the machine.

N76-10554*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
EARTH RESOURCES DATA ANALYSIS PROGRAM, PHASE 3 Final Report, Jun. 1974 - May 1975
Jun. 1975 12 p refs
(Contract NAS9-12776)
(NASA-CR-144462) Avail: NTIS HC $3.25 CSCL 05B

Tasks were performed in two areas: (1) systems analysis and (2) algorithmic development. The major effort in the systems analysis task was the development of a recommended approach to the monitoring of resource utilization data for the Large Area Crop Inventory Experiment (LACIE). Other efforts included participation in various studies concerning the LACIE Project Plan, the utility of the GE Image 100, and the specifications for a special purpose processor to be used in the LACIE. In the second task, the major effort was the development of improved algorithms for estimating proportions of unclassified remotely sensed data. Also, work was performed on optimal feature extraction and optimal feature extraction for proportion estimation. Author

N76-10555*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
LAYERED CLASSIFICATION TECHNIQUES FOR REMOTE SENSING APPLICATIONS
P. H. Swain, C. L. Wu, and D. A. Landgrebe 1975 12 p refs
(Contract NAS9-14016)
(NASA-CR-144533; LARS-IN-061275) Avail: NTIS HC $3.25 CSCL 08F

The layered classifier method is outlined and several applications to pattern classification for which the approach is suited are discussed. Author

N76-10606# Bern Univ. (Switzerland).
TERRESTRIAL RADIOMETRY AT 3mm WAVELENGTH
G. Schaerer Jun. 1974 57 p In GERMAN Sponsored by Dept. Militaire Federal Groupe. de l'Armement
(Proj. 1.5/9-68)
(CH-3000-Bern) Avail: NTIS HC $4.25

Application of passive radar at 3 mm wavelength provides for large angular resolution at reasonable antenna dimensions. Thermal resolution requires the use of low noise mixers and preamplifiers. Discrimination between metal and background at 3 mm wavelength is only obtainable with cloudless or slightly cloudy skies; rain damping is more pronounces than in the infrared region. Observational results with an imaging radiator provide a clearly recognizable presentation of earth surface properties in the microwave region. Transl. By G.G.

N76-10651# World Meteorological Organization, Geneva (Switzerland).
A 4-DIMENSIONAL ASSIMILATION OF METEOROLOGICAL OBSERVATIONS Global Atmospheric Research Program
L. Bengtsson Jan. 1975 94 p refs Prepared jointly with Intern. Council of Sci. Unions
(GARP-Publ-15) Avail: NTIS HC $4.75; WMO, Geneva

A survey was made of different kinds of data assimilation experiments, and the different observational systems to be used during the First GARP Global Experiment. The effects of systematic errors on the different data sources were studied together with methods of checking meteorological information. The different limitations for each of the two approaches to data assimilation are discussed and experiments are described. The problems of simulating experiments is also considered. Initialization procedures such as dynamical utilization and calculus of variations which have to be incorporated into data assimulator systems were investigated. Finally, results of inpact studies of assimilation of satellite observations are presented.

N76-10674*# Naval Research Lab., Washington, D.C.
ANALYSIS OF SKYLAB 2 S193 SCATTEROMETER DATA Final Report
Arthur K. Jordan, Charles G. Purves, and James F. Diggs 2 May 1975 20 p refs
(NASA Order L-7913-A; NRL Proj. R02-37)
(NASA-CR-145536; AD-A010517; NRL-7877) Avail: NTIS CSCL 04/2

SKYLAB II S193 Scatterometer data for the passes of June 5, 1973, over the Gulf of Mexico and June 6, 1973, over Pacific Hurricane AVA were analyzed. The S193 scatterometer measured the radar cross section of the ocean at 13.9 GHz (Ku-band) as a function of incidence angle. The fields-of-view of the scatterometer were known. In the absence of a large body of Ku-band ocean radar data, the results of the NRL experiments at X-band (8.9 GHz) were used for comparison. The S193 data of June 5, 1973, when a practically uniform wind field was present, show reasonable agreement with the NRL empirical and theoretical models. GRA

N76-11230# Cambridge Consultants Ltd. (England).
NON-MECHANICALLY TUNED OPTICAL BANDPASS FILTERS. A SURVEY AND ASSESSMENT Final Report
J. P. Auton, M. J. Brookfield, and J. A. Dawson Apr. 1975 170 p refs
(Contract ESTEC-2275/74-PP)
(CCL-C1011; ESA-CR(P)-664) Avail: NTIS HC $6.75

A survey and an assessment of the possibilities of changing the passband of a spectral filter by nonmechanical means and by external command is presented. Such a tunable filter could be used in earth resources surveys and atmospheric temperature sounding. Types of filters discussed are: Fabry-Perot, liquid crystal interference, acousto-optic, thermally tuned Christiansen, electro-optic polarization, thermally tuned Lyst, and switchable liquid crystal. It is concluded that for the visible region and up to about 1 micron, a polarization filter employing an electro-optically tuned liquid crystal as the birefringent materials shows the greatest promise. In the infrared region the tunable Fabry-Perot filter is by far the most promising. ESA

N76-11326# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DIGITAL SIMULATION OF A SYNTHETIC APERTURE RADAR
A. D. Goldfinger Mar. 1975 162 p refs
(Contract N00017-72-C-4401)
(AD-A011831; APL/JHU-TG-1272) Avail: NTIS CSCL 17/9

To evaluate a synthetic aperture radar being designed for the SEASAT-A satellite a digital simulation was undertaken. A system operating in spotlight mode with step-chirp pulse compression was modeled. A bottleneck analysis of the software led to an economical implementation of this model. The ocean scattering model used assumed Rayleigh statistics. Ocean surface models representing chaotic seas and deterministic patterns, such at sea ice and oil slicks, were viewed by the radar. The effects of single-bit quantization of the signal, data thinning by random

deletion of the signal, and coherent breakup of the image were investigated. Analytic models of image degradation owing to single-bit processing and image spectral distortion that is due to coherent breakup were developed and found to be consistent with the results of the simulation. GRA

N76-11485* Woods Hole Oceanographic Institution, Mass.
COMMENT ON SATELLITE ALTIMETER DATA
Carl Bowin *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 38 ref
CSCL 09F

SKYLAB mission SEASAT-B altimeter observations in combination with surface gravity measurements provide useful data on the marine geoid and expected ocean perturbations from analyses of seamount structures. G.G.

N76-11488* Puget Sound Univ., Tacoma, Wash.
SEASAT AND POLAR ICE
W. J. Campbell *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 45-46
CSCL 08L

The instrument package for SEASAT-A possesses three tools that could give data greatly needed in ice cap research: the Compressed Pulse Radar Altimeter (CPRA), the Coherent Imaging Radar (CIR), and the Scanning Multifrequency Microwave Radiometer (SMMR). Certain problems that can be studied with each sensor are discussed. Author

N76-11492* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
EXPECTED SEASAT-A SCIENTIFIC RESULTS
Frank E. Hoge *In its* Seasat-A Sci. Contrib. Jul. 1974 p 57-69 refs
CSCL 05B

The higher accuracy and extended coverage of the SEASAT-A altimeter allows for the determinations of a highly refined geoid, of open ocean currents and circulations, of ocean subsurface topography, and of earth surface topography. The radar altimeter on SEASAT-A is also considered as a tracking station in orbit for range and range rate tracking work. G.G.

N76-11503* Naval Weapons Lab., Dahlgren, Va.
POTENTIAL CONTRIBUTIONS OF SEASAT-A TO GEODETIC SCIENCE
Samuel L. Smith, III *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 124-125

CSCL 08E

It is projected that SEASAT-A will provide high resolution ocean coverage between the 72 deg latitude lines that gives data on most of the non-permanently frozen ocean areas. Data gathered by SEASAT-A in combination with terrestrial gravimetry data and orbit perturbation data allow for the computation of a worldwide geoid and gravity field with high accuracy and spatial resolution. G.G.

N76-11519*# Geological Survey, Reston, Va.
PROCESSING OF ERTS IMAGERY FOR DISSEMINATION PURPOSES Quarterly Progress Report, 18 May - 18 Aug. 1975
Hugh B. Loving, Principal Investigator 18 Aug. 1975 10 p ERTS
(Contract NAS5-3999A)
(E76-10021; NASA-CR-145414) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. This work reveals that the normal color composite rendition of land areas is not suitable for the depiction of clear shallow seas where optimum depiction of the sea bottom is critical. Either in the digital or analog, domain response must be altered from that now employed for land areas.

N76-11539*# Business and Technological Systems, Inc., Seabrook, Md.
NOISE CHARACTERISTICS OF THE SKYLAB S-193 ALTIMETER ALTITUDE MEASUREMENTS Final Report, Nov. 1974 - Aug. 1975
William E. Hatch Nov. 1975 212 p refs
(Contract NAS6-2631)
(NASA-CR-141403; BTS-TR-75-23) Avail: NTIS HC $7.75 CSCL 14B

The statistical characteristics of the SKYLAB S-193 altimeter altitude noise are considered. These results are reported in a concise format for use and analysis by the scientific community. In most instances the results have been grouped according to satellite pointing so that the effects of pointing on the statistical characteristics can be readily seen. The altimeter measurements and the processing techniques are described. The mathematical descriptions of the computer programs used for these results are included. Author

N76-11540*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
MACHINE PROCESSING OF S-192 AND SUPPORTING AIRCRAFT DATA: STUDIES OF ATMOSPHERIC EFFECTS, AGRICULTURAL CLASSIFICATIONS, AND LAND RESOURCE MAPPING Final Report, 8 Mar. 1973 - 30 Aug. 1975
F. Thomson Aug. 1975 92 p refs
(Contract NAS9-13272)
(NASA-CR-144503; ERIM-101700-27-F) Avail: NTIS HC $5.00 CSCL 08B

Two tasks of machine processing of S-192 multispectral scanner data are reviewed. In the first task, the effects of changing atmospheric and base altitude on the ability to machine-classify agricultural crops were investigated. A classifier and atmospheric effects simulation model was devised and its accuracy verified by comparison of its predicted results with S-192 processed results. In the second task, land resource maps of a mountainous area near Cripple Creek, Colorado were prepared from S-192 data collected on 4 August 1973. Author

N76-11542*# Kanner (Leo) Associates, Redwood City, Calif.
SIDE-LOOKING RADAR IMAGERY ASSEMBLY TOROS FOR STUDYING ICE DRIFT
Yu. A. Gorbunov and S. M. Losev Washington NASA Nov. 1975 17 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauch.-Issled. (Leningrad), v. 136, 1974 p 153-162
(Contract NASw-2790)
(NASA-TT-F-16664) Avail: NTIS HC $3.50 CSCL 08L

A method is proposed for elimination of scale distortions in side-looking radar images of ice cover, and distortions due to variations in aircraft drift angle and speed. The method consists essentially of graphical determination of errors and introduction of the appropriate corrections in transfer of data from the radar image to the working topographic map and then to the final map. Author

N76-11544*# Department of Energy, Mines and Resources, Ottawa (Ontario). Surveys and Mapping Branch.
INVESTIGATION OF SELECTED IMAGERY FROM SKYLAB/EREP S190 SYSTEM FOR MEDIUM AND SMALL SCALE MAPPING Final Report, Apr. 1971 - Sep. 1975
R. A. Stewart Sep. 1975 171 p
(NASA-CR-144542) Avail: NTIS HC $6.75 CSCL 08I

Satellite photography provided by the Skylab mission was investigated as a tool in planimetric mapping at medium and small scales over land surface in Canada. The main interest involved the potential usage of Skylab imagery for new and revision line mapping, photomapping possibilities, and the

application of this photography as control for conventional high altitude aerial surveys. The results of six independent investigations clearly indicate that certain selected sets of this photography are adequate for planimetric mapping purposes at scales of 1:250,000 and smaller. In limited cases, the NATO planimetric accuracy requirements for Class B 1:50,000 scale mapping were also achieved. Of the S190A photography system, the camera containing the Pan X Aerial Black and White film offers the greatest potential to mapping at small scales. However, the S190B system continually proved to offer more versatility throughout the entire investigation. Y.J.A.

N76-11550# Army Engineer Topographic Labs., Fort Belvoir, Va.
SINGLE PHOTO ANALYSIS OF SAMPLED AERIAL IMAGERY
Michael A. Crombie, Philip G. Lem, and Thomas A. Hay Aug. 1974 51 p
(DA Proj. 4A7-62707-D-853)
(AD-A012176; ETL-RN-74-10) Avail: NTIS CSCL 08/2

Three single photo analyses of aerial photography using digital techniques are presented. A statistical description of thirty scenes taken from two stereo models is presented with a preliminary matching analysis using correlation procedures and a preliminary compaction analysis using Fourier techniques. Preliminary results indicate that image compaction using Fourier techniques is feasible and promising. Several useful properties of image matching were revealed in the analysis. GRA

N76-11552# Pennsylvania Dept. of Environmental Resources, Harrisburg. Dept. of Environmental Resources.
USE OF PHOTO INTERPRETATION AND GEOLOGICAL DATA IN THE IDENTIFICATION OF SURFACE DAMAGE AND SUBSIDENCE Final Report, Nov. 1973 - Apr. 1975
Apr. 1975 246 p refs Prepared in cooperation with Earth Satellite Corp., Washington, D. C.
(PB-242468/7; ARC-73-111-2554) Avail: NTIS HC $8.00 CSCL 08I

Multi-sensor, multi-level remote sensing was examined for utility in detecting and delineating the surface expression of mine subsidence in the northern anthracite coal field of Pennsylvania. The objectives were to determine areas of potential subsidence so they can be considered in future planning and zoning processes. In this evaluation a variety of data were examined including ERTS imagery, SLAR imagery, color and color infrared photography of a number of scales, panchromatic photography acquired during the last 30 years, and spectro radiometric and thermal infrared scanner data. Maps were prepared showing geological lineaments and areas of mine subsidence were produced. GRA

N76-12227*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE JPL IMAGING RADAR EXPERIMENT IN GATE: A PRELIMINARY REPORT
Charles Elachi 15 Nov. 1975 21 p refs
(Contract NAS7-100)
(NASA-CR-145790; JPL-TM-33-751) Avail: NTIS HC $3.50 CSCL 17I

The type of data that was taken with the JPL imaging radar during the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) mission is summarized. A representative sample of the data is given. Author

N76-12229*# Hughes Aircraft Co., Culver City, Calif. Radar Avionics Div.
EARTH RESOURCES SHUTTLE IMAGING RADAR Final Report
Oct. 1975 221 p refs
(Contract NAS9-14273)
(NASA-CR-144574; P75-415) Avail: NTIS HC $7.75 CSCL 17I

A report is presented on a preliminary design of a Synthetic Array Radar (SAR) intended for experimental use with the space shuttle program. The radar is called Earth Resources Shuttle Imaging Radar (ERSIR). Its primary purpose is to determine the usefulness of SAR in monitoring and managing earth resources. The design of the ERSIR, along with tradeoffs made during its evolution is discussed. The ERSIR consists of a flight sensor for collecting the raw radar data and a ground sensor used both for reducing these radar data to images and for extracting earth resources information from the data. The flight sensor consists of two high powered coherent, pulse radars, one that operates at L and the other at X-band. Radar data, recorded on tape can be either transmitted via a digital data link to a ground terminal or the tape can be delivered to the ground station after the shuttle lands. A description of data processing equipment and display devices is given. Author

N76-12450*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG NO. N-37
30 Sep. 1975 131 p
(NASA-TM-X-72930) Avail: NTIS HC $6.00; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N76-12451*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG NO. N-38
31 Oct. 1975 103 p
(NASA-TM-X-72931) Avail: NTIS HC $5.50; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B
For abstract, see N76-12450.

N76-12452*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG NO. U-37
30 Sep. 1975 120 p
(NASA-TM-X-72926) Avail: NTIS HC $5.50; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B
For abstract, see N76-12450.

N76-12453*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG NO. U-38
31 Oct. 1975 108 p
(NASA-TM-X-145712) Avail: NTIS HC $5.50; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B
For abstract, see N76-12450.

N76-12625*# Delaware Univ., Newark. Coll. of Marine Studies.
A NEW CURRENT DROGUE SYSTEM FOR REMOTELY MONITORING SHELF CURRENT CIRCULATION
V. Klemas, Principal Investigator, G. Davis, W. Whelan (ITT Electro-Physics Labs., Columbia, Md.), and G. Tornatore (ITT Electro-Physics Labs., Columbia, Md.) 30 Oct. 1975 2 p ERTS
(Contract NAS5-20983)
(E76-10052; NASA-CR-145592) Avail: NTIS HC $3.50 CSCL 08C

The author has identified the following significant results. An ocean current drogue system was developed for use in the coastal zone and continental shelf region. The method features an extremely simple radiosonde device whose position is

determined from a pair of cooperative shore stations. These ocean sondes follow the tradition of the atmospheric radiosonde in that they are economically disposable at the end of their mission. The system was successfully tested in a number of environments, including the North Atlantic in two winter coastal storms. Tracking to the edge of the Baltimore and Wilmington trenches was achieved. The drogue system is being used in conjunction with remote sensing aircraft and satellites to chart current circulation at ocean waste disposal sites 40 miles off Delaware's coast.

N76-13548*# Helsinki Univ. (Finland). Dept. of Geology and Mineralogy.
INVESTIGATION OF LANDSAT IMAGERY ON CORRELATIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD STRUCTURES IN FINLAND Quarterly Progress Report
Heikki V. Tuominen, Principal Investigator [1975] 10 p Sponsored by NASA ERTS
(E76-00061; NASA-CR-145753; QPR-1) Avail: NTIS HC $3.50 CSCL 08G

N76-13556*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report
Saul Cooper, Principal Investigator 1 Sep. 1975 7 p Original contains color illustrations ERTS
(E76-10068; NASA-CR-145760; PR-2) Avail: NTIS HC $3.50 CSCL 05A

N76-13571# Army Engineer Topographic Labs., Fort Belvoir, Va. Geographic Sciences Lab.
PARALLEL OPTICAL PROCESSING TO CONVERT ELEVATION DATA TO SLOPE MAPS. PHASE 2: PRACTICAL CONSIDERATIONS
Avron S. Hecht Feb. 1975 21 p refs
(DA Proj. 4A1-61101-A-91D)
(AD-A012790; ETL-RN-74-12) Avail: NTIS CSCL 08/2

The considerations in designing and calibrating a coherent optical data processing system for quantitative slope computation from a transparency with amplitude transmittances as a function of surface terrain elevations are described in this report. Methods of designing the spatial filter and criteria for selecting the optical system components to minimize the errors in determining slopes are described. Procedures for calibrating the input transparency and the optical system are specified. Author (GRA)

N76-13635*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER SIMULATION OF AN AIRCRAFT-BASED DIFFERENTIAL ABSORPTION AND SCATTERING SYSTEM FOR RETRIEVAL OF SO2 VERTICAL PROFILES
James M. Hoell, Jr. Dec. 1975 34 p refs
(NASA-TN-D-8077; L-10398) Avail: NTIS HC $4.00 CSCL 13B

The feasibility of using the differential absorption and scattering technique from aircraft altitudes for remotely measuring the vertical distribution of SO2 was studied via a computer simulation. Particular care was taken in this simulation to use system parameters (i.e., laser energy, telescope size, etc.) which can be accommodated on an aircraft and can be realized with commercially available technology. The vertical molecular and aerosol profiles were chosen to simulate the types of profiles which might be experienced over a large city. Results are presented on the retrieval of the assumed SO2 profile which show the effects of systematic errors due to interfering gases and aerosols, as well as random errors due to shot noise in the return signal, detector and background noise, and instrument-generated noise. Author

N76-14439# Montana State Univ., Bozeman. Water Resources Research Center.
DIGITAL INSTRUMENTATION AND TELEMETRY FOR WATER RESOURCES RESEARCH Completion Report
Donald K. Weaver Dec. 1974 11 p refs
(OWRT Proj. B-014-MO(1))
(PB-243511/3; W75-09529) Avail: NTIS HC $3.50 CSCL 09F

The development of digital instrumentation and telemetry for water resources research is reported. Considerable study was made as to the specifications for the remote instrument package. A digital clock and multiplexor have been developed that output the standard time record each time a control signal is applied to the multiplexor control input. Several transmitter and receiver units have been incorporated in remote data acquisition systems operated by other agencies. GRA

N76-14561*# Inter-American Geodetic Survey, Fort Clayton (Canal Zone).
OVERALL EVALUATION OF SKYLAB IMAGERY FOR MAPPING OF LATIN AMERICA Final Report, Aug. 1972 - Sep. 1975
Jack E. Staples, Jorge Jose Maria Eoldan (Inst. Geografico Militar, Argentina), Oscar Wilde Fernandez (Inst. Geografico Militar, Bolivia), Miguel Alves (Inst. Brasileiro de Geografia e Estatistica, Peru), Jose Mutis (Inst. Geografico Militar, Chile), Alvaro Gonzalez Fletcher (Inst. Geografico Agustin Codazzi, Columbia), Mario Barrantes Ferrero (Inst. Geografico Nacional de Costa Rica), Jose Joaquin Hungria Morell (Inst. Geografico Univ., Republica Dominicana), Leonardo Endara Romero (Inst. Geografico Militar, Ecuador), Jose Alberto Gonzalez Garcia, Principal Investigators (Inst. Geografico Nacional, El Salvador) et al Sep. 1975 101 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4651-B)
(E76-10078; NASA-CR-144476) Avail: NTIS HC $5.50 CSCL 08B

The author has identified the following significant results. Skylab imagery is both desired and needed by the Latin American catographic agencies. The imagery is cost beneficial for the production of new mapping and maintenance of existing maps at national topographic series scales. If this information was available on a near time routine coverage basis, it would provide an excellent additional data base to the Latin American cartographic community, specifically Argentina, Bolivia, Chile, Colombia, Dominican Republic, Guatemala, Paraguay, and Venezuela.

N76-14585# Geological Survey, Sioux Falls, S. Dak.
ERTS IMAGE INTERPRETATION WORKSHOP: SYLLABUS
Jun. 1974 550 p refs Workshop held at Sioux Falls, S. D., 30 May - 28 June 1974 Sponsored in part by AID
(PB-243933/9; USGS/OFR-75/196) Avail: NTIS HC $13.00 CSCL 08F

Training of engineers, scientists, and managers involved in resources investigations of the use of remotely sensed data, especially that provided by ERTS-1 and similar satellites is outlined. The value of remote sensing to interdisciplinary/multidisciplinary cooperation in environmental analyses, resource inventories, and land-use planning is emphasized. GRA

N76-15520# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
IMPROVED APPLICATION OF GEOPHYSICS TO GROUNDWATER RESOURCES INVENTORIES IN GLACIATED TERRAINS Technical Report, 1 Jul. 1973 - 30 Jun. 1975
Jerald M. Adams, William J. Hinze, and Lynn A. Brown Jul. 1975 71 p refs
(PB-244879/3; TR-59; W75-11355; OWRT-A-030-IND(1)) Avail: NTIS HC $4.50 CSCL 08H

The use of gravity method for geophysical mapping of buried bedrock topography was discussed. The role bedrock topography in groundwater resource inventories was also covered. Where the density contrast between the bedrock and the overlying earth materials is constant, the bedrock elevation data obtained from

drill holes, outcrops, and seismic studies combined with gravity data can be used to isolate the gravity effects from bedrock relief. Preliminary induced polarization (I.P.) studies indicate that measurable I.P. effects occur within glacial sediments. A limitation of the method is the number of bedrock elevation points available to compare with observed gravity data. GRA

N76-15531*# Purdue Univ., Lafayette, Ind. The Lab. for Applications of Remote Sensing.
THE LARSYS EDUCATIONAL PACKAGE: INSTRUCTOR'S NOTES
John C. Lindenlaub and Shirley M. Davis 1974 70 p
(Contract NAS9-14016)
(NASA-CR-147391; LARS-Inform-Note-110574) Avail: NTIS HC $4.50 CSCL 09B

Materials are presented for assisting instructors in teaching the LARSYS Educational Package, which is a set of instructional materials to train people to analyze remotely sensed multispectral data. The seven units of the package are described. These units are: quantitative remote sensing, overview of the LARSYS software system, the 2780 remote terminal, demonstration of LARSYS on the 2780 remote terminal, exercises, guide to multispectral data analysis, and a case study using LARSYS for analysis of LANDSAT data. F.O.S.

N76-15553*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE MICROWAVE OBSERVATIONS OF SOIL MOISTURE VARIATIONS
T. J. Schmugge, A. Rango, and R. Neff Nov. 1975 32 p refs
(NASA-TM-X-71036; X-913-75-304) Avail: NTIS HC $4.00 CSCL 08M

The electrically scanning microwave radiometer (ESMR) on the Nimbus 5 satellite was used to observe microwave emissions from vegetated and soil surfaces over an Illinois-Indiana study area, the Mississippi Valley, and the Great Salt Lake Desert in Utah. Analysis of microwave brightness temperatures (T sub B) and antecedent rainfall over these areas provided a way to monitor variations of near-surface soil moisture. Because vegetation absorbs microwave emission from the soil at the 1.55 cm wavelength of ESMR, relative soil moistur3 measurements can only be obtained over bare or sparsely vegetated soil. In general T sub B increased during rainfree periods as evaporation of water and drying of the surface soil occurs, and drops in T sub B are experienced after significant rainfall events wet the soil. Microwave observations from space are limited to coarse resolutions (10-25 km), but it may be possible in regions with sparse vegetation cover to estimate soil moisture conditions on a watershed or agricultural district basis, particularly since daily observations can be obtained. Author

N76-15554*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACEBORNE EARTH APPLICATIONS RANGING SYSTEM (SPEAR)
F. O. Vonbun, W. D. Kahn, P. D. Argentiero, D. W. Koch, and K. J. Eng (Computer Sci. Corp.) Dec. 1975 20 p refs Proposed for presentation at COSPAR 19th Plenary Meeting, Philadelphia, 8-19 Jun. 1976
(NASA-TM-X-71035; X-920-75-299) Avail: NTIS HC $3.50 CSCL 08G

A technique is discussed for the accurate (i.e. to within fractions of cm/yr) detection of earth surface motions utilizing the latest space technology. It is shown that over a six day period and assuming a 50% cloud cover (as experienced over the last few years of laser operation) utilizing spaceborne precision ranging systems, intersite distances on the order of 5 to 15 km can be determined in the vertical and horizontal components with errors in the 0.5 to 1.5 cm range. These errors are almost independent of ground survey errors up to 0.25 meters and orbit errors up to 200 meters. A spaceborne laser ranging system is assumed to range simultaneously to two or more ground emplaced retroreflectors. The fundamental advantage derived from simultaneous ranging is the elimination to first order of errors due to the system. This means elimination of bias errors in the ranging system, errors due to propagation effects, and errors associated with the spacecraft's motion in its orbit. Author

N76-15555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POWER SPECTRA OF GEOID UNDULATIONS
Richard D. Brown Nov. 1975 21 p refs Submitted for publication
(NASA-TM-X-71028; X-921-75-300) Avail: NTIS HC $3.50 CSCL 08E

Data from spacecraft altimeters are expected to contribute to an improved determination of the marine geoid. To better define altimeter system design requirements for geoid recovery, amplitudes of geoid undulations at short wavelengths were examined. Models of detailed geoids in selected areas around the earth, developed from a combination of satellite derived spherical harmonics and 1 deg-by-1 deg area mean free-air gravity anomalies, were subjected to a spectral analysis. The resulting undulation power spectra were compared to existing estimates for the magnitude of geoid undulations at short wavelengths. The undulation spectra were found to be consistent with Kaula's rule of thumb, following an inverse third power relationship with spatial frequency for wavelengths at least as small as 300 km. The requirements imposed by this relationship on altimeter accuracy, data rate, and horizontal resolution to meet the goal of a detailed geoid description are discussed. Author

N76-15699# Naval Research Lab., Washington, D.C.
***LOW COST COMPACT* X-RAY FLUORESCENCE ANALYZER FOR ON-SITE MEASUREMENTS OF SINGLE ELEMENTS IN SOURCE EMISSIONS Final Report**
L. S. Birks and J. V. Gilfrich 26 Aug. 1975 16 p refs
(AD-A014582; NRL-7926) Avail: NTIS CSCL 14/2

A low cost, compact wavelength dispersion X-ray fluorescence analyzer has been designed using mostly state-of-the-art commercial components. A prototype instrument has been built for less than $5000 and tested in the field. With X-ray tube power of 80 watts (40 kV, 2 mA) the 100 second 3 sigma detection limits range from 0.1 to 1 microgram/sq cm for atomic numbers 23 (V) to 48 (Cd) using K alpha lines and from atomic numbers 74 (W) to 92 (U) L alpha lines. GRA

N76-15762# Delaware Univ., Newark. Coll. of Marine Studies.
INTERPRETATION OF STRUCTURES OVER OCEANIC REGIONS IN DMSP DATA
Karl-Heinz Szekielda May 1975 42 p refs
(Contract N66314-74-C-1294)
(AD-A014320; CMS-C-1-75; EPRF-TR-5-75(UD)) Avail: NTIS CSCL 08/10

Images obtained by the Defense Meteorological Satellite Program (DMSP) over the Gulf of Mexico were interpreted. In differentiating the optical characteristics of various targets, hydrography, and the frequency of occurrence of features, it was concluded that structures recognized in the offshore region were not caused by chlorophyll concentration, current boundaries (temperature gradients), sea state, or sediments. It is suggested that the atmosphere might be the significant cause for the structures recognized over cloud-free regions by the DMSP. This conclusion will be limited strictly to the case studies presented. GRA

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A76-10101 **Symposium on Meteorological Observations and Instrumentation, 3rd, Washington, D.C., February 10-13, 1975, Preprints.** Symposium sponsored by the American Meteorological Society. Boston, Mass., American Meteorological Society, 1975. 226 p. Members, $15; nonmembers, $20.

This collection of papers deals with data requirements for mesoscale and toposcale models, upper air and coastal zone observations, surface instrumentation, network operations, space- and surface-based indirect sensing, and results of field experiments. Emphasis is placed on the means of providing data for mesoscale forecast problems. Featured topics include data requirements for verification and development of models on the cumulus scale, the role of upper air observations in mesoscale networks, humidity measurement using a variable-path Lyman-alpha hygrometer, variable errors in operational data networks, quality control of upper air data from a mesoscale network, sensitive microbarographs used to study atmospheric gravity waves, performance of infrared radiometers for observations of tropospheric aerosols during gate, and observation of frontal zones and measurement of atmospheric trace constituents in coastal areas.

S.D.

A76-10312 # **Analysis of the dynamics of natural conditions and resources (Analiz dinamiki prirodnykh uslovii i resursov).** V. I. Orlov. Moscow, Izdatel'stvo Nauka, 1975. 276 p. 314 refs. In Russian.

The present work examines various remote-sensing techniques for studying the dynamic evolution of natural conditions and resources. Methods for deciphering aerial photographs are outlined, and the use of satellite surveys is considered. It is shown how aerial photographs can be employed to investigate the development and evolution of geological structures, terrain, climate factors, water resources (rivers, lakes, and swamps), soils, and vegetation. F.G.M.

A76-10508 # **Application of space photography to the study of the natural environment (Primenenie kosmicheskoi s'emki dlia izucheniia prirodnoi sredy).** Iu. F. Knizhnikov and V. I. Kravtsova. *Geodeziia i Kartografiia,* Aug. 1975, p. 52-59. In Russian.

The current status and effectiveness of U.S. and USSR earth resource technological satellites are examined. The technological and commercial aspects of this branch of space photography are discussed. V.P.

A76-11676 **Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings (L'esplorazione spaziale: La conversione e lo sfruttamento dell'energia solare; Convegno Internazionale sullo Spazio, 15th, Rome, Italy, March 17-19, 1975, Atti).** Conference sponsored by the Ministero degli Affari Esteri and Associazione Industrie Aerospaziali. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975. 460 p. In Italian, English, German, and French.

Papers are presented describing orbital and spaceflight mechanics, remote sensing studies of earth resources and geological features, the development of the European Spacelab, and efforts in the harnessing and exploitation of solar energy. Some of the topics covered include comparison of methods for determining trajectories of interplanetary space probes, thermal control of the European Space Laboratory, remote measurements of the thermal pollution of a river, solar house system interfaced with a power utility grid, and the satellite solar power station as a new frontier for space technology.

P.T.H.

A76-11679 # **Applications of remote sensing /thermal IR and multispectral images/ in the field of water resources in Italy (Applicazione delle teleosservazioni /I.R. termico e riprese multispettrali/ nel campo delle risorse idriche in Italia).** C. M. Marino (Milano, Università, Milan, Italy). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 91, 93-104. 11 refs. In Italian.

The paper discusses briefly some equipment used in remote sensing of water resources in the optical range and in the 4.5-5.5 and 8-14 micron wavelength ranges. The principle of two-layer water penetration, by which water depth can be evaluated, is described. Some pictures obtained by ERTS-1 and Skylab are presented, showing various Italian coast features in different spectral bands.

P.T.H.

A76-11682 # **Application of remote sensing techniques in the analysis of phenomena which are not exclusively of the surface type (L'impiego dei metodi di teleosservazione per l'analisi di fenomeni non esclusivamente superficiali).** A. M. Tonelli (CNR, Laboratorio per la Geofisica della Litosfera, Milan, Italy). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 139, 141-152. 26 refs. In Italian.

The paper discusses some aspects of work done in using thermal imagery for the detection of landslides, vegetative features, paleo-riverbeds, and geological lineaments. Some basic relations employed in evaluating thermal imagery for its informational content of surface and subsurface features are studied. P.T.H.

A76-11689 # **An evaluation of visual and semi-automated approaches to the recognition of spectral signatures in air survey and satellite imagery of mineralized natural terrain.** M. M. Cole, E. S. Owen-Jones, P. C. Catt, C. M. Cousans, and B. J. Chandler (Bedford College, London, England). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 261, 263-273. Research supported by the Department of Trade and Industry of England.

The paper compares the spectral signatures displayed on multispectral air survey and satellite imagery of selected areas within the Mt. Isa-Cloncurry area of Australia using visual and semi-automated approaches and evaluates them with reference to specific environmental parameters. In the semi-automated interpretation, the same area is scanned three times by a microdensitometer incorporating successively red, green and blue primary filters. Preprocessing brings it about that any of the three spectral channels is a linear combination of the other two. An unsupervised learning method was adopted for classifying the image, though in some cases, a supervised classification was made. The degree of coincidence between signatures recognized by the visual and semi-automated methods depended on the number of classification groups used, ranging from 5 to 8. P.T.H.

A76-11690 # **Remote sensing assessed as a data source and base map for resource evaluation in developing countries.** M. A. Keech (National College of Agricultural Engineering, Silsoe, Beds., England). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 275, 277-282.

ERTS-1 imagery of developing nations, with emphasis on Brazil, Rhodesia, and Sierra Leone, is evaluated as a resources management tool in the context of systems engineering. The subjects treated include: preparation of mosaics, image quality, scalar quality, locational accuracy, and the photogeological features. The agricultural land-use aspects of Rhodesian imagery are discussed. B.J.

A76-11692 # Scale-dependance of size of object-environment as a factor for object-identification in aerial photographs and satellite-images. U. Wieczorek (München, Universität, Munich, West Germany). In: Space exploration: Conversion and exploitation of solar energy; International Conference on Space, 15th, Rome, Italy, March 17-19, 1975, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1975, p. 303, 305-313.

Different scales of remote sensor images of the earth surface make difficult the comparison of such images in the study of earth surface variations. In an attempt to resolve this difficulty, the relation between information loss and scale diminution is given, as is the relation between the probability of exact identification of an object and the size of the environment of an object in the image. A simple example shows that information becomes more precise by enlarging the image scale and the area to be analyzed. B.J.

A76-11804 # Methods of increasing the informativeness of space photographs of the earth from orbital bases (Sposoby povysheniia informativnosti kosmicheskikh snimkov zemli s orbital'nykh stantsii). I. V. Almazov and N. P. Lavrova (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka, no. 6,* 1974, p. 37-42. In Russian.

Some numerical criteria are proposed for evaluating the quality of images on space photographs during photogrammetric and photolab processing. The criteria include a contrast criterion, a development kinetics criterion, a visual criterion, a dispersion criterion, and an information criterion. These criteria satisfy only interpretation requirements. Some measurement criteria are foreseen to meet the geometric requirements. V.P.

A76-12284 # Fog and stratus 'invisible' in meteorological satellite infrared /IR/ imagery. J. A. Ernst (NOAA, Satellite Field Services Station, Washington, D.C.). *Monthly Weather Review,* vol. 103, Nov. 1975, p. 1024-1026. 5 refs.

Infrared data from the Synchronous Meteorological Satellite SMS-1 which failed to indicate the presence of an existing cloud feature were examined to determine why the feature was 'invisible' to the satellite IR regardless of its ground resolution. Results indicate that the non-detection of 'invisible' fog and stratus in IR imagery may be due to a minimal temperature contrast across a large area, obtained from extracted Man-Machine Interactive Processing System data and confirmed by rawinsonde and surface data. C.K.D.

A76-12643 # Interpretation of SLAR imagery of sea ice in Nares Strait and the Arctic Ocean. M. Dunbar (Defence Research Establishment, Ottawa, Canada). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 193-213. 10 refs.

A76-12649 # Significance of surface temperature in the thermal infrared sensing of sea and lake ice. A. O. Poulin (U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Va.). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 277-282; Discussion, p. 282, 283. 9 refs.

Thermal infrared sensing can provide much information about sea ice, and some of the physical conditions associated with sea ice suggest that surface temperature may be a good indicator of ice thickness. However, steady-state heat-flow calculations suggest that the variable thickness of the snow cover and its low, variable thermal conductivity would preclude the use of surface temperature alone as a suitable indicator of ice thickness. Measurements of surface temperature, snow depth, and ice thickness suggest that, in an area of relatively uniform ice thickness, surface temperature might be useful as an indicator of snow depth if some surface data can be obtained. (Author)

A76-12655 # The use of ERTS photographs to measure the movement and deformation of sea ice. J. F. Nye (Bristol, University, Bristol, England). *(International Glaciological Society, Symposium on Remote Sensing in Glaciology, Cambridge, England, Sept. 16-20, 1974.) Journal of Glaciology,* vol. 15, no. 73, 1975, p. 429-435; Discussion, p. 435, 436. 7 refs.

A76-15024 Seasat faces multiple sensor challenges. B. M. Elson. *Aviation Week and Space Technology,* vol. 103, Dec. 8, 1975, p. 44, 45, 47.

The Seasat-A, scheduled for launch into a retrograde polar orbit in May, 1978, is discussed. The objectives of the Seasat program include mapping the global ocean geoide; measurement of precise sea-surface topography resulting from currents, tides, and storm surges; charting ice fields; global monitoring of wave height and direction, surface winds, current patterns, and ocean surface temperature; demonstration of near-realtime data processing for an operational system of global sampling. The radar altimeter, systhetic aperture imaging radar, microwave scatterometer, scanning multifrequency microwave radiometer, and visual and infrared radiometer to be carried aboard Seasat-A are described briefly. C.K.D.

A76-15451 Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Symposium sponsored by the University of Miami. Edited by T. N. Veziroglu (Miami, University, Coral Gables, Fla.). Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press (Advances in Thermal Engineering. Volume 5), 1975. 505 p. $39.

Papers are presented dealing with remote sensing of (1) meteorological, climatological, and ecological parameters, (2) pollution (material or thermal), and (3) economic energy resources by surface, airborne, or spacecraft instruments scanning large areas of the earth (land and oceans) and the earth's atmosphere. Much of the work described centers around the Earth Resources Technology Satellite (ERTS) program. Topics include monitoring of environmental quality, monitoring of land use and waterway use, applications of active and passive sensors, imaging and mapping, and measurements of hydrological and atmospheric parameters.

Individual items are announced in this issue. R.D.V.

A76-15452 * Our national energy future - The role of remote sensing. H. H. Schmitt (NASA, Office of Energy Programs, Washington, D.C.; California Institute of Technology, Pasadena, Calif.). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 5-12.

An overview of problems and opportunities in remote sensing of resources. The need for independence from foreign and precarious energy sources, availability of fossil fuel materials for other purposes (petrochemicals, fertilizer), environmental conservation, and new energy sources are singled out as the main topics. Phases of response include: (1) crisis, with reduced use of petroleum and tapping of on-shore and off-shore resources combined; (2) a transition phase involving a shift from petroleum to coal and oil shale; and (3) exploitation of renewable (inexhaustible and clean) energy. Opportunities for remote sensing in fuel production and energy conservation are discussed along with problems in identifying the spectral signatures of productive and unproductive regions. Mapping

of water resources, waste heat, byproducts, and wastes is considered in addition to opportunities for international collaboration. R.D.V.

A76-15456 * Remote sensing by ERTS satellite of vegetational resources believed to be under possible threat of environmental stress. P. Pooni, W. J. Floyd (Bethune-Cookman College, Daytona Beach, Fla.), and R. Hall (Federal Electric Corp., Cocoa Beach, Fla.). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 291-302. 7 refs. NASA-supported research.

The distribution of natural vegetation on North Merritt Island, Florida, was studied by computer analysis of ERTS satellite multispectral-scanner data. The boundaries of six distinct plant associations were located in photos produced on the image analyzer with an insignificant mean error of -24.38 meters. The six plant associations are described as: aquatic estuarine association, mangrove, spartina swamp, wooded swamp, sabal hammock, and oak-palmetto. The difference in average reflectance 'grey level' between the lowest of the four spectral scanning bands and the highest spectral scanning band for each of the six vegetation types is described. The decreasing trend of the differences is strongly negatively correlated with height of land, the coefficient of correlation being -0.9696. (Author)

A76-15457 * Remote sensing applied to numerical modelling. S. Sengupta, S. S. Lee, T. N. Veziroglu (Miami, University, Coral Gables, Fla.), and R. Bland (NASA, Kennedy Space Center, Earth Resources Branch, Cape Canaveral, Fla.). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 335-364. 35 refs.

Progress and remaining difficulties in the construction of predictive mathematical models of large bodies of water as ecosystems are reviewed. Surface temperature is at present the only variable than can be measured accurately and reliably by remote sensing techniques, but satellite infrared data are of sufficient resolution for macro-scale modeling of oceans and large lakes, and airborne radiometers are useful in meso-scale analysis (of lakes, bays, and thermal plumes). Finite-element and finite-difference techniques applied to the solution of relevant coupled time-dependent nonlinear partial differential equations are compared, and the specific problem of the Biscayne Bay and environs ecosystem is tackled in a finite-differences treatment using the rigid-lid model and a rigid-line grid system. R.D.V.

A76-15459 Remote sensing applied to energy-related problems. A. Sieber (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Porz-Wahn, West Germany). In: Remote sensing: Energy-related studies; Proceedings of the Symposium, Miami, Fla., December 2-4, 1974. Washington, D.C., Hemisphere Publishing Corp.; New York, Halsted Press, 1975, p. 445-468. 16 refs.

Remote sensing has been applied in West Germany to studies of the inflow of warm industrial effluents into river basins, infrared thermal mapping of river basins, studies of the effect of cooling towers on the immediate environment, and thermal mapping of urban centers. The article discusses thermal imaging of topography, vegetation, cold and warm air flows, heat radiation, and mapping of the microclimate in urban areas on a block-by-block basis, on a neighborhood scale, and on the scale of entire conurbations. Remote exploration of subsurface economic resources is viewed pessimistically, but interest is shown in possible detection of trace hydrocarbon gases by absorption of laser light. R.D.V.

A76-15765 # The remote measurement of water salinity using RF radiometer techniques. H. C. Wood, J. D. Robar, A. Kavadas (SED Systems, Ltd., Canada), and P. E. Vandall, Jr. (Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada). *Canadian Journal of Remote Sensing*, vol. 1, Nov. 1975, p. 67-69.

A76-15884 * Application of Fourier transforms for microwave radiometric inversions. J. J. Holmes, C. A. Balanis, and W. M. Truman (West Virginia University, Morgantown, W. Va.). *IEEE Transactions on Antennas and Propagation*, vol. AP-23, Nov. 1975, p. 797-806. 14 refs. Grant No. NGR-49-001-056.

Existing microwave radiometer technology now provides a suitable method for remote determination of the ocean surface's absolute brightness temperature. To extract the brightness temperature of the water from the antenna temperature, an unstable Fredholm integral equation of the first kind is solved. Fourier transform techniques are used to invert the integral after it is placed into a cross correlation form. Application and verification of the methods to a two-dimensional modeling of a laboratory wave tank system are included. The instability of the ill-posed Fredholm equation is examined and a restoration procedure is included which smooths the resulting oscillations. With the recent availability and advances of fast Fourier transform (FFT) techniques, the method presented becomes very attractive in the evaluation of large quantities of data. (Author)

A76-16202 Pattern recognition in remote sensing of the earth's resources. K.-S. Fu (Purdue University, West Lafayette, Ind.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics*, vol. GE-14, Jan. 1976, p. 10-18. 55 refs. NSF Grant No. ENG-74-17586.

This paper reviews some recent topics in pattern recognition as applied to remote-sensing problems. In decision-theoretic pattern recognition, four topics are presented: per-field classifications, cluster analysis and sequential partitioning procedure, feature selection, and estimation of misclassification. The syntactic approach to pattern recognition is introduced, and its application to remote-sensing problems is illustrated. Problems for further research are discussed. (Author)

A76-16203 * Classification of multispectral image data by extraction and classification of homogeneous objects. R. L. Kettig (U.S. Navy, Naval Research Laboratory, Washington, D.C.) and D. A. Landgrebe (Purdue University, West Lafayette, Ind.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics*, vol. GE-14, Jan. 1976, p. 19-26. 18 refs. Grant No. NGL-15-005-112; Contract No. NAS9-14016.

A classification method for digitized multispectral-image data is described. This method is designed to exploit a particular type of dependence between adjacent states of nature that is characteristic of the data. The advantages of this, as opposed to the conventional 'per point' approach, are greater accuracy and efficiency, and the results are in a more desirable form for most purposes. Experimental results from both aircraft and satellite data are included. (Author)

A76-16208 * Machine aided multispectral analysis utilizing Skylab thermal data for land use mapping. L. L. Biehl and L. F. Silva (Purdue University, West Lafayette, Ind.). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics*, vol. GE-14, Jan. 1976, p. 49-54. 9 refs. Contract No. NAS9-13301.

Eight-channel Skylab multispectral-scanner data obtained in January 1974 were used in a level two land-use analysis of Allen County, Indiana. The data set which includes one visible channel, four near infrared channels, two middle infrared channels, and one far infrared channel was from the X-5 detector array of the S-192

experiment in the Earth Resources Experiment Package on board the Skylab space station. The results indicate that a good quality far infrared (thermal) channel is very valuable for land use mapping during the winter months. (Author)

A76-16211 Photographic display of LANDSAT-1 CCT images for improved geological definition. T. G. Longshaw, R. P. Viljoen (Johannesburg Consolidated Investment Co., Ltd., Johannesburg, Republic of South Africa), and M. C. Hodson (South African Council for Scientific and Industrial Research, National Institute of Telecommunications Research, Johannesburg, Republic of South Africa). *(Institute of Electrical and Electronics Engineers, Conference on Machine Processing of Remotely Sensed Data, 2nd, West Lafayette, Ind., June 3-5, 1975.) IEEE Transactions on Geoscience Electronics,* vol. GE-14, Jan. 1976, p. 66-78. 10 refs.

LANDSAT-1 bulk MSS computer-compatible tapes (CCT's) maintain the intrinsic radiometric and spatial qualities of the MSS and, are potentially superior to MSS 70-mm photographic products in the study of both regional and small scale geological trends. A convenient method of realizing this potential is by using digital-to-analog conversion of processed CCT data and CRT display to produce photographic hardcopy. This paper describes a flexible method of producing such displays that can be color composited with ground-based mapping data transformed to be compatible with the MSS geometric projection. Mapping accuracy of image detail to corresponding ground features was of the order of 50 to 160 meters RMS over individual CCT areas. Two geological applications of CCT imagery are described, and in each case, the improved geological definition of CCT displays over that obtainable from NASA 70-mm transparencies is illustrated. (Author)

A76-16838 Synthetic aperture radar applications to earth resources development. L. C. Graham and H. O. Rydstrom (Goodyear Aerospace Corp., Litchfield Park, Ariz.). In: Western Electronic Show and Convention, Los Angeles, Calif., September 10-13, 1974, Proceedings. North Hollywood, Calif., Western Periodicals Co., 1974, p. 7/4 1-7/4 6.

The principles of operation of synthetic aperture radar and the synthetic interferometer are outlined. The applications of this type of terrain imaging radar to the development and management of earth resources are discussed, with special attention given to the use of the Goodyear Electronic Mapping System (GEMS) radar in monitoring sea ice conditions and in mineral exploration. The airborne GEMS synthetic aperture system images a 20-mile slant-increment strip of terrain. After ground-based optical processing the output imagery is presented at a scale of 1:400,000 in ground-range image coordinates with a resolution of about 40 ft in both dimensions. The system does not include an interferometer channel. GEMS radar mosaics have been used to identify fracture areas in Venezuela for potential minerological development. C.K.D.

A76-17544 * # Image stretching on a curved surface to improve satellite gridding. J. P. Ormsby (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Applied Meteorology,* vol. 14, Dec. 1975, p. 1594-1599. 14 refs.

A method for substantially reducing gridding errors due to satellite roll, pitch and yaw is given. A gimbal-mounted curved screen, scaled to 1:7,500,000, is used to stretch the satellite image whereby visible landmarks coincide with a projected map outline. The resulting rms position errors averaged 10.7 km as compared with 25.6 and 34.9 km for two samples of satellite imagery upon which image stretching was not performed. (Author)

A76-17700 Passive microwave remote sensing of the earth's surface. F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). *IEEE Transactions on Antennas and Propagation,* vol. AP-24, Jan. 1976, p. 112-115. 30 refs.

The use of microwave radiometry as a remote sensing tool in geoscientific investigations is discussed. Factors affecting the interaction of the sensor with the target are reviewed. The principles of operation of the total-power radiometer and the Dicke comparison radiometer are summarized. The choice of the sensor parameters for geoscientific applications is dictated by considerations including the characteristic to be measured, imaging restraints, and atmospheric effects. C.K.D.

A76-18549 Critical review of the status of remote sensing. S. A. Hempenius (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *Bildmessung und Luftbildwesen,* vol. 44, Jan. 1, 1976, p. 29-42.

The characteristics of aerial and orbital photography are examined. Side-looking airborne radar and synthetic aperture orbital radar are considered, taking into account questions of operational environment and developments in the area of orbital radar. Thermographic remote sensing methods utilizing the infrared and microwave wavelength regions are discussed along with the approaches of multispectral remote scanning. Attention is also given to questions concerning the development of orbital multispectral sensing into multitemporal sensing. G.R.

A76-18810 * # A versatile system for biological and soil chemical tests on a planetary landing craft. I - Scientific objectives. R. J. Radmer, B. Kok (Martin Marietta Laboratories, Baltimore, Md.), and J. P. Martin (Martin Marietta Aerospace, Denver, Colo.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 14th, Washington, D.C., Jan. 26-28, 1976, Paper 76-125.* 15 p. 8 refs. Contract No. NASw-2449.

We describe an approach for the remote detection and characterization of life in planetary soil samples. A mass spectrometer is used as the central sensor to monitor changes in the gas phase in eleven test cells filled with soil. Many biological assays, ranging from general 'in situ' assays to specific metabolic processes (such as photosynthesis, respiration, denitrification, etc.) can be performed by appropriate additions to the test cell via attached preloaded injector capsules. The system is also compatible with a number of chemical assays such as the analysis of atmospheric composition (both chemical and isotopic), the status of soil water, and the determination of compounds of carbon, nitrogen and sulfur in the soil. (Author)

N76-10163*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
EARTH FROM ORBIT
K. Ya. Kondratev Washington NASA Oct. 1975 13 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 6, Jun. 1975 p 38-39
(Contract NASw-2789)
(NASA-TT-F-16577) Avail: NTIS HC $3.25 CSCL 22C

The scientific gains to be realized from orbital flights of Soyuz spacecraft and Salyut orbital space stations are described. It is shown that space photography is useful in such fields as improving the environment, forestry, and meteorology.
Author

N76-10556*# Environmental Research Inst. of Michigan, Ann Arbor.
COLLATION OF EARTH RESOURCES DATA COLLECTED BY ERIM AIRBORNE SENSORS Final Report, Mar. - Jul. 1975
Philip G. Hasell, Jr. et al Sep. 1975 183 p refs
(Contract NAS9-14123)
(NASA-CR-144522; ERIM-109600-33-F) Avail: NTIS HC $7.00 CSCL 05B

Earth resources imagery from nine years of data collection with developmental airborne sensors is cataloged for reference. The imaging sensors include single and multiband line scanners and side-looking radars. The operating wavelengths of the sensors include ultraviolet, visible and infrared band scanners, and X- and L-band radar. Imagery from all bands (radar and scanner) were collected at some sites and many sites had repeated

coverage. The multiband scanner data was radiometrically calibrated. Illustrations show how the data can be used in earth resource investigations. References are made to published reports which have made use of the data in completed investigations. Data collection sponsors are identified and a procedure described for gaining access to the data. Author

N76-10557*# Nebraska Univ., Lincoln.
APPLICATIONS OF REMOTE SENSING IN RESOURCE MANAGEMENT IN NEBRASKA Semiannual Report, 1 Jan. - 30 Jun. 1975
James V. Drew 30 Jun. 1975 79 p Original contains color illustrations
(Grant NGL-28-004-020)
(NASA-CR-145400) Avail: NTIS HC $4.75 CSCL 08H

A computer-generated graphic display of land use data was developed. The level II inventory data for Sarpy County, Nebraska, was placed on magnetic tape. This data could then be displayed in a map format for comparative analysis of amount and distribution of the various categories of land use. The presentation scale can be varied and thus utilized as a direct guide for cartographic purposes during preparation for publication. In addition, the inventory and classification system was further refined. Author

N76-10560# Army Engineer Topographic Labs., Fort Belvoir, Va.
AN AUTOMATED TECHNIQUE FOR MEASURING BUILT-UP URBAN AREAS FROM MAP GRAPHICS THROUGH ANALOG IMAGE PROCESSING Research Note, Dec. 1974 - Jan. 1975
Lawrence P. Murphy and William W. Abbe May 1975 23 p refs
(DA Proj. 4A7-62707-A-854)
(AD-A011446; ETL-0012) Avail: NTIS CSCL 08/2

This research report describes a production application using experimental analog (video) image processing equipment for measuring areas (Kilometers squared) depicted on graphic map input as built-up urban areas. The note concludes that state-of-the-art analog image processing components can be configured and used to measure built-up areas in one-twelfth of the time required by conventional manual means. GRA

N76-10561# Washington Univ., Seattle. Coll. of Engineering.
ENGINEERING USES OF EROS Final Report
J. E. Colcord and Hans Bernath Sep. 1974 180 p refs
(Contract DI-14-08-0001-12865)
(PB-242108/9; USGS-LI-75-001) Avail: NTIS HC $7.00 CSCL 13B

Research directed to engineering uses of EROS considers: instrumentation; prediction of ground reflectance from image measurement; physical accuracy of scene geometry; application of ERTS and multispectral imagery to water/land boundary and runoff problems; application of ERTS imagery to geological engineering and considerations of major siting problems; and scene changes with time and other engineering data. GRA

N76-10563# Army Engineer Topographic Labs., Fort Belvoir, Va.
PRELIMINARY IMAGE DATA EXTRACTION EXPERIMENTS WITH THE PHASE 1, AUTOMATED IMAGE DATA EXTRACTION SYSTEM, 1 Research Note, Oct. 1973 - Apr. 1974
L. P. Murphy and E. G. Trelinskie, Jr. Dec. 1974 36 p refs
(AD-A010644; ETL-RN-74-7) Avail: NTIS CSCL 08/2

The research note describes an experimental device, referred to as the Automated Image Data Extraction System, and the results of a limited number of terrain data extraction experiments using multiband input images. GRA

N76-10586# Aerojet Electrosystems Co., Azusa, Calif.
DEVELOPMENT OF A PROTOTYPE AIRBORNE OIL SURVEILLANCE SYSTEM Final Report
A. T. Edgerton, J. J. Bommarito, R. S. Scwantje, and D. C. Meeks May 1975 325 p refs
(Contract DOT-CT-22170-A)
(AD-A011275; AESC-1812FR-1; USCG-D-90-75) Avail: NTIS CSCL 13/2

A prototype airborne oil surveillance system was developed for the U.S. Coast Guard by Aerojet ElectroSystems Company. The multisensor system permits real-time day/night, all-weather detection, mapping and documentation of oil spills at sea. The system was installed aboard a Coast Guard HU-16 Albatross and flight tested off the California Coast. Surveillance data were obtained from natural seeps, a series of controlled oil spills, routine shipping and targets of opportunity. The airborne system consists of a sidelooking radar, a passive microwave imager, a multispectral low light level TV, a multichannel line scanner, a position reference system, and a real-time processor/display console. The system reliably detected and mapped oil spills and seeps for conditions ranging from dense undercast to clear, wind speeds from 0 to 26 knots and daytime to total darkness. Test results demonstrate that airborne oil surveillance is practical and the system can be invaluable to other Coast Guard missions. Color illustrations reproduced in black and white. GRA

N76-10598# Coast Guard Research and Development Center, Groton, Conn.
AN OIL SLICK SAMPLING SYSTEM Final Report
Scott H. Fortier and J. Richard Jadamec Dec. 1974 20 p refs
(AD-A010708; CGR/DC-38/74; USCG-D-71-75) Avail: NTIS CSCL 13/2

An oil slick sampling system has been developed for routine sampling of oil spills for identification purposes. The system can effectively sample all types of oil spills, collecting enough sample for analysis by several analytical techniques. In 80% of the spills sampled, the system collected sufficient oil for analysis by fluorescence and infrared spectroscopic and thin layer and gas chromatographic techniques. In the remaining 20%, the system collected sufficient oil for at least two of the above-mentioned techniques. The developed system is lightweight, compact and inexpensive. GRA

N76-10605*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OPERATIONAL ALL-WEATHER GREAT LAKES ICE INFORMATION SYSTEM
R. T. Gedney 1975 12 p refs Presented at 3d Canadian Symp. on Remote Sensing, Edmonton, Alberta, 22-24 Sep. 1975
(NASA-TM-X-71812; E-8506) Avail: NTIS HC $3.25 CSCL 08L

A description is given of the NASA developed all-weather ice information system for the Great Lakes winter navigation program. The system utilizes an X-band side looking airborne radar (SLAR) for determining type, location, and areal distribution of the ice cover in the Great Lakes and an airborne, S band, down looking short pulse radar for obtaining ice thickness. Digitized SLAR data are relayed in real time via the NOAA-GOES satellite in geosynchronous orbit. The SLAR images along with hand drawn interpretative ice charts for various Great Lakes winter shipping areas are broadcast to facsimile recorders aboard vessles is the area via the MARAD marine VHF-FM radio network. These data assist such vessels in navigating both through and around the ice. Author

N76-10621# ENSCO, Inc., Springfield, Va.
DETERMINATION OF SEISMIC SOURCE DEPTHS FROM DIFFERENTIAL TRAVEL TIMES Quarterly Report, Nov. 1974 - 31 Jan. 1975
Edward Page May 1975 16 p
(Contract F08606-75-C-0025; ARPA Order 1620)
(AD-A011370) Avail: NTIS CSCL 17/10

The objective of the current project is to improve seismic depth phase detection by exploiting information contained in

the seismic coda. During the first quarter of this project the author has analyzed a well-understood event and demonstrated that depth phase detection can be enhanced through proper analysis of the seismic coda. Also indicated is how a cepstrum matched filter technique can automate the interpretation of the computed cepstrum and extract depth phase estimates. GRA

N76-10652 World Meteorological Organization, Geneva (Switzerland).
REVIEW OF OBSERVATIONAL SYSTEMS
In its A 4-Dimensional Assimilation of Meteorol. Observations Jan. 1975 p 3-16 refs
Copyright.

The observational requirements for the first GARP Global Experiment are reviewed and the accuracy and error characteristics of the different data sources are summarized. ESA

N76-11405*# Radiometric Technology, Inc., Wakefield, Mass.
APPLICATIONS OF MICROWAVES TO REMOTE SENSING OF TERRAIN Topical report, May - Oct. 1974
Ronald A. Porter Washington NASA Nov. 1975 58 p refs (Contract NAS1-13126)
(NASA-CR-2581) Avail: NTIS HC $4.50 CSCL 14B

A survey and study was conducted to define the role that microwaves may play in the measurement of a variety of terrain-related parameters. The survey consisted of discussions with many users and researchers in the field of remote sensing. In addition, a survey questionnaire was prepared and replies were solicited from these and other users and researchers. The results of the survey, and associated bibliography, were studied and conclusions were drawn as to the usefulness of radiometric systems for remote sensing of terrain. Author

N76-11506* Coastal Engineering Research Center, Fort Belvoir, Va.
EXPECTED SCIENTIFIC YIELD OF SEASAT-A AND ITS APPLICATION TO CORPS OF ENGINEERS PROGRAMS

P. G. Teleki *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 129-133
CSCL 05B

The Corps of Engineers interest in SEASAT-A is a natural outgrowth of its mission to protect and manage the Nation's shorelines. In regard to the expected payload on SEASAT-A the following general study areas can be identified: gravity waves, wind waves, wind-wave interaction, storms and hurricanes, ice, coastal currents, tsunamis, and to a very small extent geoid modelling as it applies to determination of sea level and tides. Author

N76-11509# Joint Publications Research Service, Arlington, Va.
EXPLORATION OF EARTH RESOURCES BY SPACE METHODS
Yu. K. Khodarev, ed. 6 Oct. 1975 78 p refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 p 3-94 Presented at a meeting of a working group from Socialist Countries on Exploration of Earth Resources by Space Methods, Baku, 21-27 Apr. 1975
(JPRS-65858) Avail: NTIS HC $5.00

Remote sensing by satellites is used to evaluate various earth resources, such as forests, soils, oceans, farm crops, and climate. General and thematic maps are produced using less work expenditures. Soyuz-12 observations are briefly considered.

N76-11525*# Colorado School of Mines, Golden. Dept. of Geology.
EVALUATION OF SKYLAB PHOTOGRAPHS OVER CENTRAL COLORADO FOR LOCATING INDICATORS OF MINERALIZATION
Keenan Lee, Principal Investigator and Gary L. Prost Jun. 1975 121 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Soiux Falls, S. D. 57198 EREP
(Contract NAS9-13394)
(E76-10027; NASA-CR-144513; Rept-75-3) Avail: NTIS HC $5.50 CSCL 05B

The author has identified the following significant results. Skylab S190A and S190B photographs over central Colorado, covering approximately 47,000 sq kilometers of the Rocky Mts, were analyzed to determine which features associated with known mining districts are recogniziable on space images. Results of this analysis indicate that visible features associated with mineralization include high densities of linears, complex linear intersections, red ocher, and light color (alteration) anomalies, and perhaps vegetation patterns unique to mineralized areas. Skylab photos (taken 11 June and 4 August 1973) were also studied in an attempt to locate the features indicative of mineralization. Two target areas were chosen where several favorable features coincided; a primary study area (32.5 sq km) was established at Weston Pass, and a secondary area (130 sq km) was located at Dome Rock. Ground truth, obtained at the primary target area by geologic mapping at a scale of 1:12000, was used to identify the features seen on the photography and to evaluate orbital imagery as a tool in mineral exploration. Linear features may be attributed to aligned or straight streams, ridges, vegetation, and cultural features such as roads, fences, powerlines, and contrails, as well as geologic features including faults, joints, shear zones, dikes, contacts, and paleovalleys. Red ocher colors result from sedimentary red-beds, microcline-rich crystalline rock or grus, iron oxide alteration, or combinations of these. Vegetation was influenced most by moisture, slope steepness, and seasons.

N76-11535*# Joint Publications Research Service, Arlington, Va.
SALYUT-3 PHOTOGRAPHS THE EARTH
V. D. Bolshakov and N. P. Lavrova Washington NASA Oct. 1975 7 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 3, May - Jun. 1975 p 8-11 Sponsored by NASA
(NASA-TT-F-16587) Avail: NTIS HC $3.50 CSCL 14E

Photographs taken from the manned orbital station Salyut-3 on 17 July 1974 are shown. Especially prominent in the photographs is the region of the Volga River and the Eastern part of the Atlantic Ocean. Spectral curves are included for two different types of photographic film. Author

N76-11538*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE ERTS-1 INVESTIGATION (ER-600). VOLUME 6: ERTS-1 SIGNATURE EXTENSION ANALYSIS, JULY 1972 - JUNE 1973
R. Bryan Erb Jun. 1974 88 p ref Original contains color illustrations.
(NASA-TM-X-58122; JSC-08461-Vol-6) Avail: NTIS HC $5.00 CSCL 05B

Feature classification, spatially and temporally, was extended over the Houston test site area. The Earth Resources Technology Satellite (ERTS-1) multispectral scanner data from August, September, and October 1972, of five widely separated lakes were used as statistical training fields and test sites. Short term temporal (same day to 36 days) and moderately long term spatial (within and between three ERTS multispectral scanner frames) signature extensions have been verified with respect to large relatively homogeneous features. The most significant feature dependent variable affecting spatial and short term extension was water turbidity. Long term signature extension will require a model to compensate or modify the ERTS-1 multispectral scanner data for significant sun angle changes. The presence of atmospheric haze changed the absolute signature but always by approximately the same amount so that the measured water signature was always the same. The normally occurring variations in atmospheric haze conditions had no major effect on the water signatures in this study. Author

N76-11811*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE WORKSHOP REPORT
Richard E. Matthews, ed. Washington 1975 513 p refs Presented at Working Group Meeting on the Util. of Active Microwave Systems in Appl. Programs, Houston, Tex., 22-26 Jul. 1974
(NASA-SP-376; LC-75-600062) Avail: NTIS MF $2.25; SOD HC $5.60

Data from a conference on active microwave systems are summarized. Summaries cover remote sensing of earth/land features, ocean/atmosphere interactions, and equipment and instrument technology.

N76-11818* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TECHNICAL BACKGROUND, CHAPTER 3, PART B
In its Active Microwave Workshop Report 1975 p 162-181

CSCL 17I

A description is given of the physics of electromagnetic scattering from the sea and a guideline is presented to relate an observable (such as the radar cross section) to the hydrodynamics or physical properties of the sea. As specific examples of the interdisciplinary science of electromagnetics and geophysical oceanography, the physics is discussed in connection with data provided by three instruments: namely, the scatterometer, the altimeter, and the imaging radar. The data provided by each instrument are discussed in context with specular point and Bragg scattering theories. Finally, the degrading effect of extraneous sources of noise is discussed as a limiting mechanism of the accuracy of the ocean surface measurement. Author

N76-11826* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A SHUTTLE RADAR MICROWAVE SUBSYSTEM FOR EARTH RESOURCES APPLICATIONS
In its Active Microwave Workshop Report 1975 p 420-450

CSCL 17I

Microwave subsystem considerations are discussed as a design example for a radar for earth resources applications to be used in conjunction with the shuttle spacelab. This system with a multiplicity of frequencies and polarizations - L-band (25-cm wavelength), S-band (10-cm wavelength), and X-band (3.2-cm wavelength) at two orthogonal linear polarizations - was tentatively selected. The space shuttle vehicle constrains the antenna to approximately 8 m in length and 3 m in width. The frequencies and antenna size comprise the major constraints on the system described, and determine the sensor altitude, coverage, and major hardware parameters. Author

N76-11827* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUBSURFACE SOUNDERS
In its Active Microwave Workshop Report 1975 p 450-478

CSCL 17A

Airborne or spaceborne electromagnetic systems used to detect subsurface features are discussed. Data are given as a function of resistivity of ground material, magnetic permeability of free space, and angular frequency. It was noted that resistivities vary with the water content and temperature. Author

N76-12427*# Wolf Research and Development Corp., Pocomoke City, Md.
APPLICABILITY OF SATELLITE REMOTE SENSING FOR DETECTION AND MONITORING OF COAL STRIP MINING ACTIVITIES Final Technical Report, Mar. 1973 - Sep. 1975
Ronald L. Brooks, Principal Investigator and Carlos G. Parra Sep. 1975 88 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13310)
(E76-10038; NASA-CR-144474) Avail: NTIS HC $5.00 CSCL 08I

The author has identified the following significant results. Large areas covered by orbital photography allows the user to estimate the acreage of strip mining activity from a few frames. Infrared photography both in color and in black and white transparencies was found to be the best suited for this purpose.

N76-12447*# Kansas Univ. Center for Research, Inc., Lawrence.
EFFECT OF PRECIPITATION ON CHOICE OF FREQUENCY FOR SEASAT SCATTEROMETER
George Dome Jul. 1975 54 p refs
(Contract NAS1-10048)
(NASA-CR-132749; CRES-TR-186-14) Avail: NTIS HC $4.50 CSCL 14B

Precipitation backscatter limits the effectiveness of a remote sensing radar in a satellite. Scatterometer operation on SEASAT is considered in one of the following frequency ranges: 12.5 GHz; 13.4-14.0 GHz; and 14.4-15.35 GHz. The effect of backscatter from precipitation in these frequency ranges is compared. Author

N76-13562*# Martin Marietta Corp., Baltimore, Md.
SKYLAB PROGRAM EARTH RESOURCES EXPERIMENT PACKAGE SENSOR PERFORMANCE EVALUATION, VOLUME 1, (S190A) Final Report
Gerald P. Kenney 12 May 1975 106 p refs
(Contract NAS8-24000)
(NASA-CR-144563; MSC-05546-Vol-1) Avail: NTIS HC $5.50 CSCL 05B

The results of S190A sensor performance evaluation are summarized based on data presented by all contributors to the sensor performance evaluation interim reports. Techniques used in sensor performance evaluation are discussed. Topics discussed include: performance degradation identified during the Skylab missions, S190A and EREP system anomalies that affected S190A performance, and the performance achieved, in terms of pertinent S190A parameters. Additional analyses include final performance analyses completed after submittal of the SL4 interim sensor performance evaluation reports, including completion of detailed analyses of basic performance parameters initiated during the interim report periods and consolidation analyses to reduce independent mission data (SL2, SL3, and SL4) to determine overall performance realized during all three Skylab missions. Author

N76-13563*# Martin Marietta Corp., Baltimore, Md.
SKYLAB PROGRAM EARTH RESOURCES EXPERIMENT PACKAGE SENSOR PERFORMANCE EVALUATION, VOLUME 3, (S192) Final Report
Gerald P. Kenney 5 May 1975 106 p refs
(Contract NAS8-24000)
(NASA-CR-144564; MSC-05546-Vol-3) Avail: NTIS HC $5.50 CSCL 05B

For abstract, see N76-13562.

N76-13578# Environmental Research Inst. of Michigan, Ann Arbor.
BASIC REMOTE SENSING INVESTIGATIONS FOR BEACH RECONNAISSANCE Interim Report, Apr. - Dec. 1974
D. J. Leu, C. T. Wezernak, P. Jackson, F. Thompson, and R. Shuchman Aug. 1975 90 p refs
(Contract N00014-74-C-0273)
(AD-A013338; ERIM-108900-3-T) Avail: NTIS CSCL 08/6

Progress is reported on three tasks designed to develop remote sensing beach reconnaissance techniques applicable to the benthic, beach intertidal, and beach upland zones. Task 1 is designed to develop remote sensing indicators of important beach composition and physical parameters which will ultimately prove useful in models to predict beach conditions. Task 2 is

designed to develop remote sensing techniques for survey of bottom features in the benthic zone. Task 3 is designed to develop radar processing techniques to delineate important beach intertidal and upland parameters and to better understand the potential of radar-derived information when used with optical sensor data. GRA

N76-13638*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PRELIMINARY REPORT OF MULTISPECTRAL SCANNER DATA FROM THE CLEVELAND HARBOR STUDY
Don Shook, Charles Raquet, Roger Svehla, Douglas Wachter, Jack Salzman, Tom Coney, and Dick Gedney Nov. 1975 40 p refs Sponsored in part by EPA
(NASA-TM-X-71837; E-8550) Avail: NTIS HC $4.00 CSCL 13B

Imagery obtained from an airborne multispectral scanner is presented. A synoptic view of the entire study area is shown for a number of time periods and for a number of spectral bands. Using several bands, sediment distributions, thermal plumes, and Rhodamine B dye distributions are shown. Author

N76-14557 Washington Univ., Seattle.
INTEGRATION OF REMOTE SENSING AND PHOTOGRAMMETRY: A UNIFIED DIGITAL APPROACH TO INTERPRETATION AND MAPPING OF MULTISPECTRAL AERIAL PHOTOGRAPHY Ph.D. Thesis
Hans Jakob Bernath 1974 154 p
Avail: Univ. Microfilms Order No. 75-28318

Remote sensing is conceived as a mapping of a multidimensional object space onto another vector space of the same or fewer dimensions. It is a general transformation of the geometric and radiometric variables. Hence image interpretation or specifically photointerpretation is the inverse of this imaging function. A comprehensive mathematical model is formulated to describe the remote sensing data acquisition and interpretation problem. The behavior of the numerous parameters involved is quantified and relationships are established. The capability of the total digital concept is demonstrated by an example of automated land use mapping of a suburban environment. The theoretical limits of the automated approach are investigated and visually displayed by a set of computer maps. Dissert. Abstr.

N76-14558*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DESIGN DATA COLLECTION WITH SKYLAB MICROWAVE RADIOMETER-SCATTEROMETER S-193, VOLUME 2 Final Report, 26 Mar. 1973 - 31 Dec. 1975
Richard K. Moore and Fawwaz T. Ulaby, Principal Investigators Aug. 1975 119 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13331)
(E76-10075; NASA-CR-144538; RSL-TR-243-12-Vol-2) Avail: NTIS HC $5.50 CSCL 08B

The author has identified the following significant results. Skylab S-193 radiometer/scatterometer produced terrain responses with various polarizations and observation angles for cells of 100 to 400 sq km area. Classification of the observations into natural categories was achieved by K-means and spatial clustering algorithms. Microwave data acquired over the Great Salt Lake Desert area by sensors aboard Skylab and Nimbus 5 indicate that the microwave emission and backscatter were strongly influenced by contributions from subsurface layers of sediment saturated with brine. Correlations were noted between microwave backscatter response at approximately 33 deg from scatterometer (operating at 13.9 GHz) and the configuration of ground targets in Brazil as discerned from coarse scale maps. With limited, available ground truth, these correlations were sufficient to permit the production of image-like displays which bear a marked resemblance to known terrain features in several instances.

N76-14559*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DESIGN DATA COLLECTION WITH SKYLAB MICROWAVE RADIOMETER-SCATTEROMETER S-193, VOLUME 1 Final Report
Richard K. Moore and Fawwaz T. Ulaby, Principal Investigators Sep. 1975 682 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13331)
(E76-10076; NASA-CR-144537; RSL-TR-243-12-Vol-1) Avail: NTIS HC $16.25 CSCL 08B

The author has identified the following significant results. Observations with S-193 have provided radar design information for systems to be flown on spacecraft, but only at 13.9 GHz and for land areas over the United States and Brazil plus a few other areas of the world for which this kind of analysis was not made. Observations only extended out to about 50 deg angle of incidence. The value of a sensor with such a gross resolution for most overland resource and status monitoring systems seems marginal, with the possible exception of monitoring soil moisture and major vegetation variations. The complementary nature of the scatterometer and radiometer systems was demonstrated by the correlation analysis. Although radiometers must have spatial resolutions dictated by antenna size, radars can use synthetic aperture techniques to achieve much finer resolutions. Multiplicity of modes in the S-193 sensors complicated both the system development and its employment. An attempt was made in the design of the S-193 to arrange optimum integration times for each angle and type of measurement. This unnecessarily complicated the design of the instrument, since the gains in precision achieved in this way were marginal. Either a software-controllable integration time or a set of only two or three integration times would have been better.

N76-14568*# Cornell Univ., Ithaca, N.Y. Resource Information Lab.
ENHANCEMENT AND EVALUATION OF SKYLAB PHOTOGRAPHY FOR POTENTIAL LAND USE INVENTORIES, PART 1 Final Report, 1 May 1973 - 31 Jul. 1975
E. E. Hardy, Principal Investigator, J. E Skaley, C. P. Dawson, G. D. Weiner, E. S. Phillips, and R. A. Fisher Jul. 1975 216 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13364)
(E76-10085; NASA-CR-144473) Avail: NTIS HC $7.75 CSCL 08B

The author has identified the following significant results. Three sites were evaluated for land use inventory: Finger Lakes - Tompkins County, Lower Hudson Valley - Newburgh, and Suffolk County - Long Island. Special photo enhancement processes were developed to standardize the density range and contrast among S190A negatives. Enhanced black and white enlargements were converted to color by contact printing onto diazo film. A color prediction model related the density values on each spectral band for each category of land use to the spectral properties of the various diazo dyes. The S190A multispectral system proved to be almost as effective as the S190B high resolution camera for inventorying land use. Aggregate error for Level 1 averaged about 12% while Level 2 aggregate error averaged about 25%. The S190A system proved to be much superior to LANDSAT in inventorying land use, primarily because of increased resolution.

N76-15438*# South Alabama Univ., Mobile.
LASER DOPPLER SPECTROMETER METHOD OF PARTICLE SIZING Final Report, 15 Jun. 1974 - 15 Jan. 1976
F. Neff Weber 15 Jan. 1976 18 p refs
(Grant NsG-3003)
Avail: NTIS HC $3.50 CSCL 14B

A spectrometer for the detection of airborne particulate pollution in the submicron size range is described. In this device, airborne particles are accelerated through a supersonic nozzle, with different sizes achieving different velocities in the gas flow. Information about the velocities of the accelerated

particles is obtained with a laser-heterodyne optical system through the Doppler shift of light scattered from the particles. Detection is accomplished by means of a photomultiplier. Nozzle design and signal processing techniques are also discussed.
Author

N76-15454# Transportation Systems Center, Cambridge, Mass.
THE DEVELOPMENT OF AN EXPERIMENTAL AIRBORNE LASER REMOTE SENSOR FOR OIL DETECTION AND CLASSIFICATION IN SPILLS Final Report
John F. Fantasia and Hector C. Ingrao Feb. 1975 165 p refs
(Contract DOT-PPA-CG-03)
(AD-A013580; TSC-USCG-74-5; USCG-D-86-75) Avail: NTIS CSCL 14/2

A study and measurements program to determine the feasibility of using laser-excited oil fluorescence as a means of detecting and classifying oils in spills in the marine environment was undertaken at the DOT/Transportation Systems Center. The study consisted of an analysis of the fluorescence properties of oils and oil slicks on the sea surface, and a theoretical analysis of the remote fluorometry of oil spills. As a result of this study a laboratory and field measurements program was undertaken. Laboratory measurements were made of 29 crude and refined oils commonly transported in the marine environment. These measurements included API gravity, fluorescence and reflectance spectra, fluorescence coefficient and fluorescence lifetimes. Similar measurements were made with a laboratory model of an N2 laser oil spill remote sensor. Results of these measurements showed that, under certain conditions, oil spill detection and classification can be made in the marine environment. GRA

N76-15527*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CLASSIFICATION OF MULTISPECTRAL IMAGE DATA BY EXTRACTION AND CLASSIFICATION OF HOMOGENEOUS OBJECTS
R. L. Kettig and D. A. Landgrebe 1975 19 p refs
(Contract NAS9-14016; Grant NGL-15-005-112)
(NASA-CR-147406; LARS-Inform-Note-062375) Avail: NTIS HC $3.50 CSCL 09B

A method of classification of digitized multispectral image data is described. It is designed to exploit a particular type of dependence between adjacent states of nature that is characteristic of the data. The advantages of this, as opposed to the conventional per point approach, are greater accuracy and efficiency, and the results are in a more desirable form for most purposes. Experimental results from both aircraft and satellite data are included. Author

N76-15530*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A CASE STUDY USING LARSYS FOR ANALYSIS OF LANDSAT DATA
Tina K. Cary and John C. Lindenlaub 1975 142 p
(Contract NAS9-14016)
(NASA-CR-147404; LARS-Inform-Note-050575) Avail: NTIS HC $6.00 CSCL 09B

Techniques are described for analysis of LANDSAT multispectral using the LARSYS data processing system. J.M.S.

N76-15534*# Alabama Univ., University. Dept. of Geology and Geography.
ASSESSMENT OF PRACTICALITY OF REMOTE SENSING TECHNIQUES FOR A STUDY OF THE EFFECTS OF STRIP MINING IN ALABAMA Final Report, 1 Jul. 1973 - 30 Jun. 1975
Travis H. Hughes, Andrew C. Dillion, III, James R. White, Jr., S. E. Drummond, Jr., and W. Gary Hooks 30 Jun. 1975 190 p refs
(Contract NAS8-29936; Proj. 1-3-80-0084(1F))
(NASA-CR-144126) Avail: NTIS HC $7.50 CSCL 08I

Because of the volume of coal produced by strip mining, the proximity of mining operations, and the diversity of mining methods (e.g. contour stripping, area stripping, multiple seam stripping, and augering, as well as underground mining), the Warrior Coal Basin seemed best suited for initial studies on the physical impact of strip mining in Alabama. Two test sites, (Cordova and Searles) representative of the various strip mining techniques and environmental problems, were chosen for intensive studies of the correlation between remote sensing and ground truth data. Efforts were eventually concentrated in the Searles Area, since it is more accessible and offers a better opportunity for study of erosional and depositional processes than the Cordova Area. Author

N76-15552*# Ecosystems International, Inc., Gambrills, Md.
USER REQUIREMENTS AND USER ACCEPTANCE OF CURRENT AND NEXT-GENERATION SATELLITE MISSION AND SENSOR COMPLEMENT, ORIENTED TOWARD THE MONITORING OF WATER RESOURCES Final Report, Jun. - Oct. 1975
Peter A. Castruccio, Harry L. Loats, Thomas R. Fowler, and Paul Robinson Dec. 1975 95 p refs
(Contract NAS5-20567)
(NASA-CR-144712; ECO-75:C-3-4) Avail: NTIS HC $5.00 CSCL 08H

Principal water resources users were surveyed to determine the applicability of remotely sensed data to their present and future requirements. Analysis of responses was used to assess the levels of adequacy of LANDSAT 1 and 2 in fulfilling hydrological functions, and to derive systems specifications for future water resources-oriented remote sensing satellite systems. The analysis indicates that water resources applications for all but the very large users require: (1) resolutions on the order of 15 meters, (2) a number of radiometric levels of the same order as currently used in LANDSAT 1 (64), (3) a number of spectral bands not in excess of those used in LANDSAT 1, and (4) a repetition frequency on the order of 2 weeks. The users had little feel for the value of new sensors (thermal IR, passive and active microwaves). What is needed in this area is to achieve specific demonstrations of the utility of these sensors and submit the results to the users to evince their judgement. Author

N76-15723# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
AEROMETHODS IN GEOCRYOLOGY
I. V. Protaseva Jul. 1975 189 p refs Transl. into ENGLISH from mono "Aerometody v Geokriologii" Moscow, 1967 196 p
(AD-A014143; CRREL-TL-482) Avail: NTIS CSCL 08/12

The book discusses the use of aeromethods for studying the development of permafrost soils (rocks) and permafrost phenomena connected with them. Theoretical and methodical conclusions were drawn which can be used as a basis for a further broader adoption of aeromethods into the practice of regional and topical studies of the tendencies in the distribution, composition, structure and properties of permafrost soils.
GRA

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09
GENERAL

Includes economic analysis.

A76-15772 **Complementary roles of spacecraft and aircraft in remote sensing of earth's resources.** A. J. Moffat (Litton Systems/Canada/, Ltd.,Rexdale, Ontario, Canada) and W. F. Kohler. *Canadian Journal of Remote Sensing,* vol. 1, Nov. 1975, p. M-16 to M-18. 7 refs.

The relative roles of the remote sensing techniques and data collecting capabilities of aircraft and satellite-borne remote sensing systems in the observation and/or measurement of various parameters of earth resources are considered. Satellite systems are best suited to synoptic mapping of surface features of large areal extent and the imaging of data involving slow changes in the observed resource. Aircraft lend themselves to the study of rapidly changing phenomena and for the high-resolution study of smaller geographical areas. Aircraft systems can be used to verify and complement certain types of satellite data. C.K.D.

A76-16826 **Western Electronic Show and Convention, Los Angeles, Calif., September 10-13, 1974, Proceedings.** Conference sponsored by the Institute of Electrical and Electronics Engineers. North Hollywood, Calif., Western Periodicals Co. (WESCON Technical Papers. Volume 18), 1974. 673 p. $75.

Papers are presented dealing with recent advances in electronics technology, including charge-coupled devices, encapsulated semiconductors, microprocessors, LSI testing, and display technology. Some of the topics covered are CCD image sensors, microwave varactor tuned oscillators, broadband microwave mixers incorporating balanced-line hybrids, recent developments in airborne moving target indicator radars, electronic means of livestock identification, reliability of ceramic and plastic encapsulated integrated circuits in a computer environment, artificial pacemaker evaluation methods, and a field-alterable control element (FACE) for computer processors. P.T.H.

A76-17362 # **A European earth resources survey space programme.** J. Plevin (ESRO, Future Space Applications Div., Neuilly-sur-Seine, Hauts-de-Seine, France). *Association Aéronautique et Astronautique de France, Symposium Spatial Européen, 14th, Toulouse, France, Apr. 23-25, 1975, Paper.* 15 p. 10 refs.

European long-term interests in earth resources satellite program are discussed from the standpoint of both regional and global requirements. On the basis of definite long-term objectives, the optimum role played by Europe in earth resources satellite programs is examined relative to regional monitoring, global monitoring, and development aid. The need for cooperation with non-European agencies is stressed, and preliminary suggestions are set forth for optimum levels of European participation in these various programs. An examination of the multifaceted elements in the earth resources satellite programs shows that there still remains an immense amount of work to be fulfilled, such as the development of high-efficiency microwave remote sensing and data processing techniques. S.D.

A76-17366 # **Cooperation between France and European countries in remote sensing of earth resources (Coopération entre la France et les pays européens en télédétection des ressources terrestres).** M. Chevrel (Centre National d'Etudes Spatiales, Paris, France). *Association Aéronautique et Astronautique de France, Symposium Spatial Européen, 14th, Toulouse, France, Apr. 23-25, 1975, Paper.* 6 p. In French.

The paper reviews briefly the sensors and data processing facilities available for any cooperative programs among European countries in the field of remote sensing. Some individual programs planned or under way are mentioned. For example, a Franco-Swedish agreement plans to study the usefulness of multispectral techniques in agriculture, forestry, and environmental protection, as well as to investigate the possibility of comparing subarctic vegetation with that of alpine and subalpine regions. A France-Netherlands campaign plans airborne remote sensing of agricultural, geological, and hydrological resources. It is suggested that studies of this nature be extended to the European scale. P.T.H.

A76-17367 # **An opportunity for Europe - The high accuracy positioning system GEOLE.** G. Brachet and J.-L. Maury (Centre National d'Etudes Spatiales, Paris, France). *Association Aéronautique et Astronautique de France, Symposium Spatial Européen, 14th, Toulouse, France, Apr. 23-25, 1975, Paper.* 46 p. 7 refs.

The GEOLE satellite system is discussed from the viewpoint of the primary mission objective: to provide highly reliable operational positioning fixes on the earth's surface with an accuracy of one meter for geodetic, topographic, and cartographic applications. It is noted that positions will be computed with respect to a reference system and materialized by a polyhedron of permanent ground transponders, providing a unique worldwide reference system. The basic operational principle of the GEOLE system is described along with its main components, which include one or more satellites, a system of ground transponders, onboard and ground-based measurement instruments, and a center for data processing and operations control. The instrument error budget is outlined together with the spacecraft functions, the transponder tasks, and the role of the control center. Geometric and orbital techniques for computing positions are compared, and additional capabilities of the GEOLE system are noted. The potential market for the GEOLE system is evaluated. F.G.M.

N76-10927# Committee on Science and Technology (U. S. House).
FUTURE SPACE PROGRAMS, 1975, VOLUME 1
Washington GPO Sep. 1975 73 p refs Rept. of Subcomm. on Space Sci. and Appl. for Comm. on Sci. and Technol., 94th Congr., 1st Sess., Sep. 1975
(GPO-56-846) Avail: SOD HC $0.95

A discussion of the technological benefits of space exploration and how it contributes to human progress is presented. Topics considered are: (1) space colonies; (2) space manufacturing; (3) energy; (4) climatology and earth resources; (5) communications; and (6) study of the universe and its contents. J.R.T.

N76-10934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN SCIENCE AND TECHNOLOGY, GODDARD SPACE FLIGHT CENTER, 1974
Washington 1975 208 p refs Proc. of a Symp. held at Greenbelt, Md., 5 Dec. 1974
(NASA-SP-384) Avail: NTIS HC $7.25 CSCL 05B

Topics covered are: (1) earth resources (climatology, oceanography, soils, strip mines), and (2) astronomy (magnetic fields and atmospheres of the planets and the sun; galactic and interstellar gas; cosmic and X-ray radiation). Photographs of satellite observations are included. J.R.T.

N76-11482*# National Aeronautics and Space Administration, Washington, D.C.
SEASAT-A SCIENTIFIC CONTRIBUTIONS
Jul. 1974 172 p refs
(NASA-TM-X-72944) Avail: NTIS HC $6.75 CSCL 05B

SEASAT-A planned instrument complement and capabilities are reported together with an estimate of expected scientific contributions from satellite oceanic measurements

N76-11483* National Aeronautics and Space Administration, Washington, D.C.
A SYNOPSIS OF SEASAT-A SCIENTIFIC CONTRIBUTIONS

John R. Apel (NOAA) and Joseph W. Siry *In its* Seasat-A Sci. Contrib. Jul. 1974 p 3-30 refs

CSCL 08E

SEASAT-A satellite data processing and modelling capabilities address scientific and applications problems in the domains of oceanic, atmospheric, and solid earth geophysics studies by the use of active radar, and passive microwave and infrared instruments. A data flow map depicts the interrelationship between SEASAT-A instruments and other sources of information and the geophysical parameters to be determined. G.G.

N76-11484* Lockheed Missiles and Space Co., San Diego, Calif. Ocean Lab.
COMMENTS ON POTENTIAL SEASAT APPLICATIONS
Ledolph Baer *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 33-37 ref
CSCL 08E

Potential benefits of expected SEASAT-A capabilities include oceanographic support of industrial and commercial activities, rapid dissemination of data in forecast-type activities, greater monitoring abilities at better spatial resolutions, and long time operational data gathering. G.G.

N76-11495* Battelle Columbus Labs., Ohio.
CIVIL AND SCIENTIFIC APPLICATIONS OF THE GEOID

A. George Mourad *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 79-84
CSCL 08B

SEASAT-A can be used for determining the geoid to much higher accuracy on a world wide basis and in a relatively short time. Two basic objectives can be considered: (1) determination of the geoid to at least 1 meter. This accuracy will satisfy most geodetic requirements for applications purposes; and (2) determination of the geoid to better than 1-meter an oceanographic objective required for measurement of sea surface topography and sea slope, quasi-stationary departure from the geoid, ocean circulation, air and sea interaction, etc. The geodesy objective in this case will be to define a reference equipotential surface as a means by which the oceanographic requirements can be achieved. Author

N76-11541*# Marine Environmental Sciences Consortium, Dauphin Island, Ala.
CHARACTERIZATION OF USERS OF REMOTELY-SENSED DATA IN THE ALABAMA COASTAL ZONE
Barry A. Vittor, ed. Mar. 1975 161 p refs
(Contract NAS8-30810)
(NASA-CR-144058) Avail: NTIS HC $6.75 CSCL 08J

Federal, State, local, universities and private companies were polled to determine their needs for remote sensing data. A total of 62 users were polled. Poll results are given in tables. A comprehensive research program was developed to satisfy user needs, and is examined for the disciplines of Geology, Water Resources, Archaelogy, Geography, and Conservation. An investigation of silt plume discharge from Mobile Bay is also examined. Sample poll forms used in the surveys are shown. J.R.T.

N76-11545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMPACT OF EARTH RESOURCES EXPLORATION FROM SPACE
William Nordberg Sep. 1975 13 p Presented at 31st Nobel Symp. on The Impact of Space Science on Mankind, Spatind, Norway, 8-12 Sep. 1975
(NASA-TM-X-71010; X-900-75-250) Avail: NTIS HC $3.50 CSCL 08G

The use of Earth Resources Technology Satellites in solving global problems is examined. Topics discussed are: (1) management of food, water, and fiber resources; (2) exploration and management of energy and mineral resources; (3) protection of the environment; (4) protection of life and property; and (5) improvements in shipping and navigation. J.R.T.

N76-12425*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 1 CUMULATIVE NON-US STANDARD CATALOG. OBSERVATION ID LISTING. COORDINATE LISTING
23 Jul. 1975 562 p
(NASA-TM-X-72929) Avail: NTIS HC $13.50; EROS Data Center, Sioux Falls, S. D. 57198 HC $1.25 CSCL 05B

The catalog includes data pertaining to imagery acquired by LANDSAT 1 from July 23, 1974 through July 23, 1975. Two listings of imagery are included: (1) an observation identification listing, and (2) a listing based on geographic location (coordinate listing). World maps of satellite coverage are given. Author

N76-12443*# National Research Council, Bangkok (Thailand).
THAILAND NATIONAL PROGRAMME OF THE EARTH RESOURCES TECHNOLOGY SATELLITE Progress Report
Sanga Sabhasri and Choompol Swasdiyakorn, Principal Investigators Oct. 1975 6 p refs Sponsored by NASA ERTS
(E76-10055; NASA-CR-145595) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. Forest inventory of Thailand was completed in January 1975, using LANDSAT-1 imagery and ground truth survey. Results showed the existing forest covers only 37% of the land area. The last country-wide survey using aerial survey photographs at 1:60,000 scale conducted in 1961 gave the figure of 58%. ERTS-1 imagery showed that Thailand's mangrove forest covers an area of approximately 3130 sq k. The previous aerial survey showed 3681 sq k of mangroves.

N76-12448*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 1 CUMULATIVE US STANDARD CATALOG. VOLUME 1: OBSERVATION ID LISTING, 23 JULY 1974 - 23 JULY 1975
23 Jul. 1975 354 p
(NASA-TM-X-72928) Avail: NTIS HC $10.50; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

Data are presented of imagery acquired by LANDSAT 1 from July 23, 1974 through July 23, 1975. Two listings of the imagery are included. In Volume 1, an observation identification listing is given, and in Volume 2, a listing of the imagery based on geographic listing (coordinate listing) is given. Author

N76-12449*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 1 CUMULATIVE US STANDARD CATALOG. VOLUME 2: COORDINATE LISTING, 23 JULY 1974 - 23 JULY 1975
23 Jul. 1975 376 p
(NASA-TM-X-72927) Avail: NTIS HC $10.75; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

For abstract, see N76-12448.

N76-12877# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 29, NUMBER 6
Waldo G. Magnuson, Jr. and Victoria S. Hewitson 30 Jun. 1975 49 p refs
(AD-A012349; ESN-29-6) Avail: NTIS CSCL 05/2

The monthly publication presents brief articles concerning recent developments in European Scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. GRA

N76-12890# Naval Intelligence Support Center, Washington, D.C. Translation Div.
OCEAN, TECHNOLOGY, LAW

1 May 1975 256 p refs Transl. into ENGLISH from the monograph "Okean, Tekhnika" Moscow, Pravo, 1972
(AD-A012079; NISC-Trans-3664) Avail: NTIS CSCL 05/4

Contents: Legal problems of international straits, canals and historic waters; Legal problems of the territorial sea, the continental shelf and the seabed; International legal protection of the world ocean from pollution and the preservation of living resources. GRA

N76-13558*# Servicio Geologico de Bolivia, La Paz.
EARTH RESOURCES TECHNOLOGY SATELLITE DATA COLLECTION PROJECT ERTS-1, BOLIVIA Final Report, Jul. 1972 - Apr. 1974
Carlos E. Brockmann, Principal Investigator Apr. 1974 164 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10071; NASA-CR-145763; Rept-4) Avail: NTIS HC $6.75 CSCL 05B

N76-13559*# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
COLLECTION OF RELEVANT RESULTS OBTAINED WITH THE ERTS-1 SATELLITE IMAGES BY THE INSTITUTE FOR SPACE RESEARCH (INPE), VOLUME 1 Final Report, Oct. 1972 - Dec. 1974
Fernando deMendonca, Gilberto Amaral, and Emmanuel Gama-DeAlmeida, Principal Investigators Jan. 1975 256 p refs Revised Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10072; NASA-CR-145764; INPE-606-LAFE-Vol-1-Rev) Avail: NTIS HC $9.00 CSCL 05B

N76-13560*# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
COLLECTION OF RELEVANT RESULTS OBTAINED WITH THE ERTS-1 SATELLITE IMAGES BY THE INSTITUTE FOR SPACE RESEARCH (INPE), VOLUME 2 Final Report
Fernando DeMendonca, Gilberto Amaral, and Emmanuel GamaDeAlmeida, Principal Investigators Jan. 1975 214 p refs Revised Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10073; NASA-CR-145765; INPE-606-LAFE-Vol-2-Rev) Avail: NTIS HC $7.75 CSCL 05B

The author has identified the following significant results. Soil resource studies in Brazil have concluded that: areas with agricultural activities appear surrounding urban centers; some areas are suffering a strong erosion action; there exist two drainage systems near Paraguai River and Parana River; and this region possesses great variety of soil types. It is possible to count the number of lakes and sluices as well as their superficial area using a channel 7 photographic enlargement. The great concentration of water bodies along the Jacui River determines the large rice crops. Data concerning regions around Teresina City, Presidente Prudente, Piracicaba City, Dourados, and Tres Marias Dam revealed several characteristics concerning the soil and water resources. Two basic maps were made of the natural vegetation distribution over central eastern Brazil from data ERTS-1 data. One map shows the drainage system, the road system, and cities; while the second shows the natural vegetation. It was possible to identify old reforestation, new reforestation, natural forest in flat lands, and natural forest in rolling lands from the ERTS images. Different pasture plant species could be identified by multispectral remote sensing. Data obtained along different wavelength bands provide essential data for the range manager to evaluate his range and to establish a suitable policy. Hydrographic mapping was done using the ERTS images.

N76-13565*# Transemantics, Inc., Washington, D.C.
USERS MANUAL FOR ERTS SATELLITE (LANDSAT) DATA
Evaldo Santos Pinheiro, Luiz Paulo Tavares, and Marcio Nogugira Barbosa NASA Nov. 1975 64 p Transl. into ENGLISH from the Brazilian report INPE/668/NTE/009
(Contract NASw-2792)
(NASA-TT-F-16642; INPE/668/NTE/009) Avail: NTIS HC $4.50 CSCL 09B

A manual designed to inform users of the main features of the ERTS Program and to standardize their access to the data obtained by means of remote sensor systems is introduced. Author

N76-13568*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA PLANS FOR FUTURE EARTH RESOURCES MISSIONS
W. Nordberg Oct. 1975 18 p Presented at 1st Ann. William T. Pecora Memorial Symp., Sioux Falls, S. D., Oct. 1975
(NASA-TM-X-71025; X-900-75-295) Avail: NTIS HC $3.50 CSCL 05B

Development activities underway to improve LANDSAT sensors and observing systems are reported. Data cover high resolution imagery of surface temperatures for improving crop and other vegetation and soil classifications, and heat capacity mapping for recording surface temperatures at hours of maximum and minimum heating. Automatic identification and classification methods designed to extract information such as crop and forage acreages, amounts of water run-off, and types of land use directly from the satellite observations were also studied. A number of applications verification tests were conducted, particularly in the areas of crop and land use inventory and water run-off prediction, to demonstrate the direct transfer of space acquired information to end users. Author

N76-14017# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.
SPACE ACTIVITIES IN FINLAND IN 1974
Martti Tiuri, ed. and Seppo Urpo,ed. 1975 11 p refs
(Rept-S-72; ISBN-951-750-486-1) Avail: NTIS HC $3.50

A summary is presented of activities within the national space program of Finland. The space applications programs include activities in the fields of remote sensing of earth resources and the environment, meteorology, communications, and navigation. Space research includes the ionosphere and magnetosphere, lunar and meteoritic research, satellite geodesy, and satellite orbits. Finland's role in international cooperation is outlined. ESA

N76-14579*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OPERATIONS: REMOTE SENSING EXPERIMENTS IN THE NEW YORK BIGHT, 7-17 APRIL 1975
J. W. Usry and J. B. Hall, Jr. Nov. 1975 62 p refs
(NASA-TM-X-72802) Avail: NTIS HC $4.50 CSCL 08B

Results are given of remote sensing experiments conducted in the New York Bight between April 7-17, 1975, to evaluate the role of remote sensing technology to aid in monitoring ocean dumping. Remote sensors were flown on the C-54, U-2, and C-130 aircraft while the National Oceanic and Atmospheric Administration obtained concurrent in situ sea truth data using helicopters and surface platforms. The test site, aircraft platforms, experiments, and supporting sensors are described. The operation of each aircraft are discussed and aircraft flight lines, flight parameters, and data identification parameters are presented in figures and tables. Author

N76-15015*# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS OF THE INTERAGENCY WORKSHOP ON LIGHTER THAN AIR VEHICLES
Joseph F. Vittek, Jr., ed. Jan. 1975 692 p refs Proc. held at Monterey, Calif., Sep. 1974 Sponsored in part by Navy, DOT, and FAA

(Grant NsG-2024)
(NASA-CR-137800; FTL-R75-2) Avail: NTIS HC $16.25 CSCL 01B

Papers presented at the workshop are reported. Topics discussed include: economic and market analysis, technical and design considerations, manufacturing and operations, design concepts, airship applications, and unmanned and tethered systems.

N76-15072* Developmental Sciences, Inc., City of Industry, Calif.
REMOTELY PILOTED LTA VEHICLE FOR SURVEILLANCE

Gerald R. Seemann, Gordon L. Harris, and Glen J. Brown *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 679-683

CSCL 01C

Various aspects of a remotely piloted mini-LTA vehicle for surveillance, monitoring and measurement for civilian and military applications are considered. Applications, operations and economics are discussed. Author

N76-15213# European Space Agency, Paris (France).
REMOTE SENSING FROM SPACELAB: A CASE FOR INTERNATIONAL COOPERATION
J. Plevin 1974 32 p refs Presented at the 2d Symp. on Remote Sensing of Man's Environ., Bristol, Engl., Sep. 1974
Avail: NTIS HC $4.00

A brief description is given of the Spacelab system and ideas on its role in earth resources surveys from space. The need for cooperative action is mentioned and arguments presented to show that the basis of cooperation needs to be established now if effective use is to be made of the potential of Spacelab and the automatic operational satellites that will follow. ESA

N76-15240# Geological Survey, Reston, Va.
WORLDWIDE DISASTER WARNING AND ASSESSMENT WITH EARTH RESOURCES TECHNOLOGY SATELLITES Final Report
Charles J. Robinove Aug. 1975 71 p
(PB-244382/8; USGS-GD-75-017; IR-NC-47) Avail: NTIS HC $4.50 CSCL 13L

On the basis of experimental results, the potential use of Earth Resources Technology Satellites (ERTS) for worldwide disaster or monitoring and the techniques used for application of ERTS data to disaster monitoring and analysis are described. Problems and recommended solutions to arrive at an operational disaster monitoring capability are presented. GRA

N76-15535*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG Monthly Report, 1 Nov. - 30 Nov. 1975
30 Nov. 1975 95 p
(NASA-TM-X-72952; GFSC/U-39; NTISUB/A/138-75/011) Avail: NTIS HC $5.00; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

The U.S. Standard Catalog lists imagery of the continental U.S., Alaska and Hawaii acquired by Landsat 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-15536*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG Monthly Report, 1 Nov. - 30 Nov. 1975
30 Nov. 1975 74 p
(NASA-TM-X-72953; GSFC/N-39; NTISUB/A/139-75/011) Avail: NTIS HC $4.50; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by Landsat 1 and 2 which was processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found are also given. Author

N76-15557# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
DEFINITION OF THE TECHNICAL REQUIREMENTS FOR AN EARTH RESOURCES PAYLOAD FOR THE SPACELAB (WITH RESPECT TO EUROPEAN USER REQUIREMENTS). FOLLOW-ON STUDY Final Report
31 Jul. 1974 120 p refs Original contains color illustrations
(Contract ESA-SC/3/73-HQ)
(MBB-ERP-74/01; ESA-CR(P)-712) Avail: NTIS HC $5.50

Some special problem areas were investigated for the Spacelab earth resources payload's European user requirements. The generation of clear data for some typical orbit types with respect to ground coverage and measurement repetition in relation to agreed test sites is discussed. Operational areas time-lines, data, and power profiles for the different orbits are examined. The inclusion of an atmospheric sensor package as support and calibration sensors for remote sensing is studied, including some stratospheric and air quality measurements. Besides two additional orbits, a correlation is discussed between the orbit characteristics and the measurement conditions such as test site coverage, measurement repetition per day and per mission, and contact times under typical view angles. ESA

N76-15756# Coastal Zone Resources Corp., Wilmington, N.C.
A STUDY TO ASSESS GOALS FOR USES AND MANAGEMENT OF SHORELINE AND IMPLICATIONS FOR CORPS OF ENGINEERS PROGRAMS Final Report
Jul. 1975 106 p refs
(Contract DACW31-75-C-0017)
(AD-A014157; IWR-CR-75-4) Avail: NTIS CSCL 13/2

A high level of activity relating to use and management of shorelines and the coastal zone is in evidence. The study is an assessment of the significance of legislation, policies and actions affecting the coastal zone at all levels of government. The assessed activities are interpreted for their significance to Corps of Engineer programs in shore protection. The study concludes that the states assert their authority for the coastal zone management function and the Federal agencies should help identify and perform activities complimentary to state programs. Further the Corps is advised to formulize its technical support relationships with state coastal zone agencies, develop and prepare educational materials to assist in coastal zone problems, expand research in coastal problems and explain remote sensing technology. GRA

N76-15901*# Stanford Research Inst., Huntsville, Ala.
USER BENEFITS AND FUNDING STRATEGIES Final Report, May - Oct. 1975
J. L. Archer, N. A. Beauchamp, and C. F. Day Oct. 1975 157 p refs
(Contract NAS5-22371)
(NASA-CR-144706) Avail: NTIS HC $6.75 CSCL 05A

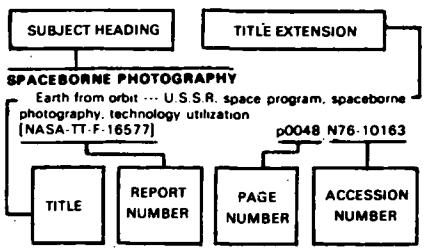
The justification, economic and technological benefits of NASA Space Programs (aside from pure scientific objectives), in improving the quality of life in the United States is discussed and outlined. Specifically, a three-step, systematic method is *described for selecting relevant and highly beneficial payloads* and instruments for the Interim Upper Stage (IUS) that will be used with the space shuttle until the space tug becomes available. Viable Government and private industry cost-sharing strategies which would maximize the number of IUS payloads, and the benefits obtainable under a limited NASA budget were also determined. Charts are shown which list the payload instruments, and their relevance in contributing to such areas as earth resources management, agriculture, weather forecasting, and many others. J.R.T.

N76-15959# Centre National d'Etudes Spatiales, Paris (France).
FRENCH SPACE PROGRAM: REPORT TO COSPAR [PROGRAMME SPATIAL FRANCAIS. RAPPORT AU COSPAR]
1975 112 p refs In FRENCH Presented at the 18th COSPAR Assembly, Varna, Bulg., May 1975
Avail: NTIS HC $5.50

Programs and results obtained are reviewed for all French laboratories working in areas of research related to space. Main topics include lunar specimen studies; spectroscopic planetology; space radiation; ionospheric and magnetospherics; aeronomy; meteorology, comprising the Meteosat program and the Eole experiment and earth resources investigations; geodesy; and geodynamics-research covering space biology and exobiology is also discussed. French satellites and sounding rockets are listed, as well as French experiments onboard foreign spacecraft. (ESA)

SUBJECT INDEX

Typical Subject Index Listing



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A

ACCURACY
Review of observational systems --- for first GARP Global Experiment noting accuracy of data sources p0050 N76-10652

ADRIATIC SEA
Geomorphic and landform survey of northern Appennini [E76-10077] p0014 N76-14560

AERATION
Soil physical conditions under maize --- sensitivity of maize to soil temperature, moisture and aeration p0004 N76-11661

AERIAL PHOTOGRAPHY
Analysis of the dynamics of natural conditions and resources --- Russian book on remote sensing techniques p0045 A76-10312
An evaluation of visual and semi-automated approaches to the recognition of spectral signatures in air survey and satellite imagery of mineralized natural terrain p0045 A76-11689
Scale-dependance of size of object-environment as a factor for object-identification in aerial photographs and satellite-images p0046 A76-11692
Some results measuring ocean surface parameters from aerial photographs p0023 A76-11807
Interpretation of SLAR imagery of sea ice in Nares Strait and the Arctic Ocean p0046 A76-12643
Applications of remote sensing to the study of the biosphere --- French book p0008 A76-15675
Complementary roles of spacecraft and aircraft in remote sensing of earth's resources p0055 A76-15772
Spectral signature selection for mapping unvegetated soils p0038 A76-16292
Synthetic aperture radar applications to earth resources development p0048 A76-16838
Contactless radar mapping of warm valley glaciers - Transformation of radar coordinates p0030 A76-17570
Critical review of the status of remote sensing p0048 A76-18549
Single photo analysis of sampled aerial imagery [AD-A012176] p0042 N76-11550
A comparative study of texture measures for terrain classification [AD-A012905] p0004 N76-13470
A preliminary report of multispectral scanner data from the Cleveland harbor study [NASA-TM-X-71837] p0052 N76-13638
Catalog of tidal inlet aerial photography [AD-A012798] p0028 N76-13714
Integration of remote sensing and photogrammetry: A unified digital approach to interpretation and mapping of multispectral aerial photography p0052 N76-14557
Aeromethods in geocryology --- aerial photography and photogrammetry of permafrost [AD-A014143] p0053 N76-15723

AERIAL RECONNAISSANCE
Airborne laser profiling of swell in an open ice field p0024 A76-14445
Basic remote sensing investigations for beach reconnaissance [AD-A013338] p0051 N76-13578
National Aeronautics and Space Administration operations: Remote sensing experiments in the New York Bight, 7-17 April 1975 [NASA-TM-X-72802] p0057 N76-14579

AEROSOLS
Variable width rectangular slit jet impactor p0037 A76-15968
Use of a laser resonator for raising the sensitivity of laser-type aerosol spectrometers p0039 A76-17712
Determination of aerosol content in the atmosphere from Landsat data [E76-10067] p0013 N76-13554

AEROSPACE SCIENCES
Geographic problems and the possibilities of their solution by aerospace methods p0010 N76-11511

AEROSPACE SYSTEMS
European scientific notes, volume 29, number 6 [AD-A012349] p0056 N76-12877

AFRICA
Use of ERTS imagery for natural resources research and development in Lesotho --- Southern Africa [E76-10018] p0009 N76-10550
Agroclimatology of the highlands of eastern Africa --- conference proceedings [WMO-389] p0011 N76-11640
Nature conservation and water resources: Aspects of the highlands of eastern Africa p0030 N76-11657

AGRICULTURE
Wheat productivity estimates using LANDSAT data [E76-10003] p0001 N76-10535
Application and evaluation of satellite remote sensing data and automatic processing techniques for state-wide land use and other resource management --- Mississippi [E76-10004] p0009 N76-10536
Photointerpretation of Skylab photography [E76-10006] p0009 N76-10538
Applied regional monitoring of the vernal advancement and retrogradation (Green wave effect) of natural vegetation in the Great Plains corridor [E76-10009] p0001 N76-10541
Use of ERTS imagery for natural resources research and development in Lesotho --- Southern Africa [E76-10018] p0009 N76-10550
A radiative transfer model for microwave emissions from bare agricultural soils [NASA-TM-X-58166] p0009 N76-10552
Grown organic matter as a fuel raw material resource [NASA-CR-2608] p0002 N76-10569
Problems in remote sensing of land resources and agricultural crops p0002 N76-11513
Crop identification and acreage estimation over large geographic areas using LANDSAT MSS data --- Indiana [E76-10033] p0003 N76-11531
Agroclimatology of the highlands of eastern Africa --- conference proceedings [WMO-389] p0011 N76-11640
Agriculture, forestry, range, and soils, chapter 2, part C p0004 N76-11815
Regional agricultural surveys using ERTS-1 data [E76-10037] p0004 N76-12426
Applicability of satellite remote sensing for detection and monitoring of coal strip mining activities --- Kentucky [E76-10038] p0051 N76-12427
Interdisciplinary applications and interpretations of ERTS data within the Susquehanna River Basin --- Stone Valley and Jefferson and Lancaster counties [E76-10049] p0031 N76-12438
Interdisciplinary applications and interpretations of ERTS data within the Susquehanna River Basin [E76-10051] p0020 N76-12440
Use of LANDSAT imagery for wildlife habitat mapping in northeast and east central Alaska [E76-10059] p0005 N76-13546
Computer mapping of Landsat data for environmental applications [E76-10064] p0013 N76-13551
Collection of relevant results obtained with the ERTS-1 satellite images by the Institute for Space Research (INPE), volume 2 --- Brazil [E76-10073] p0057 N76-13560
Application of Landsat to the surveillance and control of lake eutrophication in the Great Lakes basin [E76-10074] p0032 N76-13561

AIR MASSES
Study of mesocale exchange processes utilizing LANDSAT air mass cloud imagery [E76-10005] p0009 N76-10537

AIR POLLUTION
A gas sampling and static reactor system for use in evaluating the environmental fate of volatile chemicals from industrial processes at trace levels - Application to volatile inorganic hydrides as used in the semiconductor industry p0007 A76-14556
Study of laser radar system using the differential absorption method for detection of air pollutants p0007 A76-15414
Recent developments in environmental sensing with the Barringer Correlation Spectrometer p0008 A76-15768
Carbon monoxide pollution experiment [NASA-CR-132717] p0010 N76-10579
Active microwave sensing of the atmosphere, chapter 4 p0012 N76-11822
Interdisciplinary applications and interpretations of ERTS data within the Susquehanna River Basin --- Stone Valley and Jefferson and Lancaster counties [E76-10049] p0031 N76-12438
Computer simulation of an aircraft-based differential absorption and scattering system for retrieval of SO2 vertical profiles [NASA-TN-D-8077] p0043 N76-13635
A preliminary study of air-pollution measurement by active remote-sensing techniques [NASA-CR-132724] p0015 N76-14647
Benzene, environmental sources of contamination, ambient levels, and fate [PB-244139/2] p0016 N76-15675

AIR SAMPLING
Variable width rectangular slit jet impactor p0037 A76-15968

AIR WATER INTERACTIONS
The application of the Nimbus 5 ESMR to sea surface wind determination --- Electrically Scanning Microwave Radiometers p0023 A76-10108
Some results measuring ocean surface parameters from aerial photographs p0023 A76-11807
AIDJEX bulletin number 28 [PB-242435/6] p0027 N76-12460
AIDJEX bulletin number 29 [PB-244424/8] p0028 N76-15523

AIRBORNE EQUIPMENT
Comparison of sea-ice type identification between airborne dual-frequency passive microwave radiometry and standard laser/infrared techniques p0036 A76-12645
Temperature measurement of ice and water surfaces in the North Water area using an airborne radiation thermometer p0036 A76-12646
Characterization of cold-regions terrain using airborne laser profilometry p0036 A76-12651
Airborne electromagnetic surveys - Their contribution to the discovery of natural earth resources p0037 A76-13367
Recent developments in environmental sensing with the Barringer Correlation Spectrometer p0008 A76-15768
Latest developments with an air-borne gas filter correlation spectrometer p0037 A76-15770
Variable width rectangular slit jet impactor p0037 A76-15968
Subsurface sounders p0051 N76-11827
Spaceborne Earth Applications Ranging system (SPEAR) [NASA-TM-X-71035] p0044 N76-15554

AIRBORNE SURVEILLANCE RADAR
Relationship between coordinates of terrain points and the coordinates of image points for side-looking radars with an antenna directed along the fuselage p0035 A76-11805
Great Lakes all-weather ice information system p0039 A76-18503

AIRSHIPS
Proceedings of the Interagency Workshop on lighter than air vehicles [NASA-CR-137800] p0057 N76-15015
Remotely piloted LTA vehicle for surveillance p0058 N76-15072

ALABAMA
Characterization of users of remotely-sensed data in the Alabama coastal zone --- user requirements, surveys - technology utilization [NASA-CR-144058] p0056 N76-11541

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

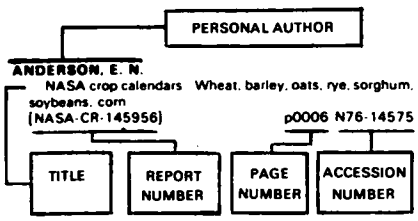
W

X

Y

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title, e.g., p0006 N76-14575. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

ABBE, W. W.
An automated technique for measuring built-up urban areas from map graphics through analog image processing
[AD-A011446] p0049 N76-10560

ABDEL-GAWAD, M.
Analysis of tectonic features in US southwest from Skylab photographs
[E76-10034] p0020 N76-11532

ADAM, N. V.
Analysis of the residual geomagnetic field according to the Cosmos-49 model p0019 A76-11939

ADAMS, J. M.
Improved application of geophysics to groundwater resources inventories in glaciated terrains
[PB-244879/3] p0043 N76-15520

ALDRICH, R. W.
Extensive inventory of forest resources by multistage sampling
[E76-10013] p0001 N76-10545

ALFOLDI, T. T.
Chromaticity changes from isoluminous techniques used to enhance multispectral remote sensing data p0038 A76-16293

ALISHOUSE, J. C.
A summary of the radiometric technology model of the ocean surface in the microwave region
[COM-75-10849-8] p0011 N76-11683

ALLAN, A. Y.
Maize production trends in Kenya and the influence of seasonal rainfall variations on output p0004 N76-11660

ALMAZOV, I. V.
Methods of increasing the informativeness of space photographs of the earth from orbital bases p0046 A76-11804

ALVES, M.
Overall evaluation of Skylab imagery for mapping of Latin America
[E76-10078] p0043 N76-14561

AMARAL, G.
Collection of relevant results obtained with the ERTS-1 satellite images by the Institute for Space Research (INPE), volume 1
[E76-10072] p0057 N76-13559
Collection of relevant results obtained with the ERTS-1 satellite images by the Institute for Space Research (INPE), volume 2
[E76-10073] p0057 N76-13560

AMSBURY, D. L.
Space acquired imagery, a versatile tool in the development of energy sources p0015 A76-15458

ANDERLE, R. J.
Practical realization of a reference system for earth dynamics by satellite methods p0018 A76-17245

ANDERSON, D. M.
Land use/vegetation mapping in reservoir management. Merrimack River basin
[NASA-CR-145822] p0013 N76-13586

ANDERSON, E. N.
NASA crop calendars: Wheat, barley, oats, rye, sorghum, soybeans, corn
[NASA-CR-145956] p0006 N76-14575

APEL, J. R.
A synopsis of Seasat-A scientific contributions p0055 N76-11483
The Earth and Ocean Physics Applications Program (EOPAP). Ocean dynamics program p0026 N76-11508

ARCESE, R.
Applications of the Nimbus 5 ESMR to rainfall detection over the oceans and to sea-ice detection
[AD-A013245] p0027 N76-13710

ARCHER, J. L.
User benefits and funding strategies
[NASA-CR-144706] p0058 N76-15901

ARGENTIERO, P. D.
Spaceborne Earth Applications Ranging system (SPEAR)
[NASA-TM-X-71035] p0044 N76-15554

ASPIAZU, C.
Cropland acreage estimates from temporal, multispectral ERTS-1 data p0001 A76-16294

AUTON, J. P.
Non-mechanically tuned optical bandpass filters. A survey and assessment
[CCL-C1011] p0040 N76-11230

B

BAER, L.
Comments on potential Seasat applications p0056 N76-11484

BALANIS, C. A.
Application of Fourier transforms for microwave radiometric inversions p0047 A76-15884

BANDSTON, P. T.
Application and evaluation of satellite remote sensing data and automatic processing techniques for state-wide land use and other resource management
[E76-10004] p0009 N76-10536

BANNERT, D.
Multispectral Scanning Systems and their potential application to earth-resources surveys. II - Earth-science applications p0037 A76-13549

BARBOSA, M. N.
Users manual for ERTS satellite (LANDSAT) data
[NASA-TT-F-16642] p0057 N76-13565

BARKER, J. L.
Monitoring water quality from LANDSAT
[NASA-TM-X-71006] p0030 N76-11543

BARR, D. M.
Canonical analysis and transformation of Skylab multispectral scanner data
[E76-10002] p0039 N76-10534

BARTHOLOMEW, J. C.
Cartographic research in EREP program for small scale mapping
[E76-10039] p0018 N76-12428

BARTLE, E. R.
Infrared sensor for the remote monitoring of SO2
[PB-243478/5] p0014 N76-14584

BARTLETT, D.
Application of Landsat-2 to the management of Delaware's marine and wetland resources
[E76-10044] p0027 N76-12433
Coastal zone classification from satellite imagery
[E76-10046] p0027 N76-12435

BARWIS, J. H.
Catalog of tidal inlet aerial photography
[AD-A012798] p0028 N76-13714

BASHARINOV, A. E.
Study of the condition of continental covers and water areas by microwave-radiometric methods p0035 A76-12003

BASHARINOV, A. Y.
Simulation studies of the SHF radiation characteristics of soils under moist conditions
[NASA-TT-F-16489] p0005 N76-13669

BATLIVALA, P. P.
Diurnal variations of radar backscatter from a vegetation canopy p0008 A76-17678

BAUER, M. E.
Technological basis and applications of remote sensing of the earth's resources p0038 A76-16201
Crop identification and acreage estimation over large geographic areas using LANDSAT MSS data
[E76-10033] p0003 N76-11531
Crop Identification Technology Assessment for Remote Sensing (CITARS)
[NASA-CR-147389] p0006 N76-15528
The use of ERTS-1 multispectral imagery for crop identification in a semi-arid climate
[NASA-CR-147405] p0006 N76-15533

BAUMGARDNER, M. F.
The use of ERTS-1 multispectral imagery for crop identification in a semi-arid climate
[NASA-CR-147405] p0006 N76-15533

BAXTER, F. P.
Soil and land cover overlay analyses p0001 A76-15499

BEAUCHAMP, N. A.
User benefits and funding strategies
[NASA-CR-144706] p0058 N76-15901

BECKETT, P. H. T.
Multispectral Scanning Systems and their potential application to earth-resources surveys. II - Earth-science applications p0037 A76-13549

BENGTSSON, L.
A 4-dimensional assimilation of meteorological observations
[GARP-PUBL-15] p0040 N76-10651

BENKOVA, N. P.
Analysis of the residual geomagnetic field according to the Cosmos-49 model p0019 A76-11939

BENNING, W.
A comparison of methods for computing surface densities of the geopotential from satellite altimetry p0017 A76-12225

BENSON, A. S.
Regional agricultural surveys using ERTS-1 data
[E76-10037] p0004 N76-12426

BENTLEY, G.
Ground truth data from Arizona and Montana test sites
[E76-10069] p0005 N76-13556

BERNATH, H.
Engineering uses of EROS
[PB-242108/9] p0049 N76-10561

BERNATH, H. J.
Integration of remote sensing and photogrammetry: A unified digital approach to interpretation and mapping of multispectral aerial photography p0052 N76-14557

BEVAN, B.
Detection of crop mark contrast for archaeological surveys
[E76-10036] p0003 N76-11534

BICKMORE, D. P.
Multispectral Scanning Systems and their potential application to earth-resources surveys. II - Earth-science applications p0037 A76-13549

BIEHL, L. L.
Machine aided multispectral analysis utilizing Skylab thermal data for land use mapping p0047 A76-16208

BINDER, A.
Resource and Land Investigations (RALI) program: An approach to environmental assessment with application to western coal development
[PB-244632/6] p0015 N76-15568

BIRKS, L. S.
Low cost compact X-ray fluorescence analyzer for on-site measurements of single elements in source emissions
[AD-A014582] p0044 N76-15699

BISSELLE, A.
Resource and Land Investigations (RALI) program: An approach to environmental assessment with application to western coal development
[PB-244632/6] p0015 N76-15568

BIZZELL, R. M.
Crop Identification Technolgy Assessment for Remote Sensing (CITARS). Volume 1: Task design plan
[NASA-CR-144571] p0004 N76-12454

BJORKLAND, J.
Aerial thermal scanner data for monitoring rooftop temperatures
[NASA-CR-145747] p0011 N76-11546

BLAIR, B. O.
The use of ERTS-1 multispectral imagery for crop identification in a semi-arid climate
[NASA-CR-147405] p0006 N76-15533

BLAND, R.
Remote sensing applied to numerical modelling p0047 A76-15457

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Z

CORPORATE SOURCE INDEX

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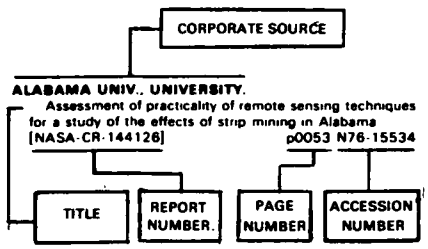

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A

B

C

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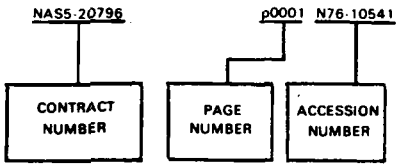

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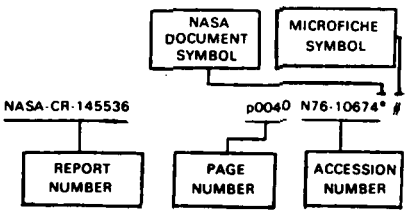
REPORT/ACCESSION NUMBER INDEX

Typical Report /Accession Number Index Listing



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NASA SP-7041 (09)		

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7. Author(s)	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code

15. Supplementary Notes

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NASA SP-7039	NASA PATENT ABSTRACTS BIBLIOGRAPHY NASA patents and applications for patent	Semiannually
NASA SP-7041	EARTH RESOURCES Remote sensing of earth resources by aircraft and spacecraft	Quarterly
NASA SP-7043	ENERGY Energy sources, solar energy, energy conversion, transport, and storage	Quarterly
NASA SP-7500	MANAGEMENT Program, contract, and personnel management, and management techniques	Annually

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